

Climate change and human health: risks and responses

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In 1996 a group of health researchers organized by WHO, the World Meteorological Organization (WMO), and the United Nations Environment Programme (UNEP) published the first comprehensive assessment of climate change and human health (1). *Climate change and human health: risks and responses* updates this work — and opens new pathways through which to examine the consequences the future climate may hold for the ecological systems that underpin our health. As the rates of warming, CO₂ build-up, and weather anomalies increase, events that have previously been projected merely as scenarios have begun to unfold and they have already begun to influence our health, biological diversity, and the global economy.

Climate change and human health: risks and responses, whose thirteen chapters are written by leading experts, examines those disease outcomes that are attributable to climate change, the methodologies used to assess them, the use of scenarios in generating policy options, and the means of adapting to a changing climate. A WHO report issued in 2002 attributed 160 000 deaths annually to climate change. Considering the increasing weather volatility and severity that is accompanying rapid warming and the accumulating heat in the deep ocean (2) — this is probably a vast underestimate; and this work gives proper attention to this dimension of climate change so crucial for understanding its wide-ranging impacts on health and ecological systems. While temperature constrains the range of infectious diseases and disease vectors (as it does for all plant and animals), it is severe weather that is taking the greatest toll on the health of nations.

Over the last six years, extreme precipitation events, heatwaves and

droughts have been responsible for disease outbreaks and unprecedented loss of human life. Hurricane Mitch dropped almost two metres of rain in three days on Honduras in 1998, killing over 11 000 people, and left a “cluster” of water-, vector- and rodent-borne diseases. In Venezuela in 1999 severe rains whipped up an outbreak of Venezuelan equine encephalitis, while landslides killed tens of thousands. In Mozambique in 2000 intense flooding and three cyclones over a six-week period left the country with epidemics of malaria and cholera and displaced tens of thousands.

The tempo of outlier climatological events (those outside 2 or 3 standard deviations from the mean) is quickening. The temperatures and mortality levels associated with the surprisingly intense 2003 European summer heatwave far exceeded all model projections (and sparked wildfires and crop failures as well as an estimated 10% reduction in Alpine glaciers). In May 2004 a total of 1.5 metres of rain fell on Hispaniola in 36 hours, killing over 3300 people; and 520 tornadoes battered a middle-swath of the USA. Then, on 27 June 2004, 40 cm of rain fell on Guam in 24 hours, shattering daily rainfall records. In August Hurricane Charley with 143 miles per hour winds cut a devastating path across Jamaica, Cuba then Florida in the US, killing 27 and causing over US\$ 20 billion in property and agricultural losses, and business interruptions. The pace of large storms continues and we are now in the sixth consecutive year of drought (perhaps the longest in 500 years) in the western states of the US, which is attributable to anomalous Pacific Ocean conditions, described as “The perfect ocean for drought” (3). The pace of such anomalies is punishing for many nations and the wide swings from norms indicate instability and increased propensity for more surprises, shifts and shocks.

There are several scenarios of abrupt change — including thawing of permafrost, releasing methane, and rapid sea level rise resulting from slippage of the Antarctic Peninsula or Greenland ice shelves. (The Greenland ice shelf is now melting at 10 metres per annum, up exponentially from the 1 metre per year measured in 2000!) The potential for a “cold reversal” in the Northern

Hemisphere deserves particular mention. Scandinavia could see fewer of the Lyme-disease and virus-carrying ticks that are now migrating northwards, lockstep with each warm winter. Winters may be as cool — or crueler — as those the north-east US experienced in 2002–04. Europe is already experiencing the higher circumpolar and cross Atlantic wind speeds from the freshening and cooling of the North Atlantic — resulting from melting polar and Greenland ice and more rain falling at high latitudes (from evaporation of warmed, saltier tropical oceans). Evaporation levels over cool waters are less than those from warm ocean surfaces, and the droughts and heatwaves in Europe are attributable in great part to such coupled ocean-atmospheric changes occurring at high latitudes. (Mirror image changes are occurring in the Southern Hemisphere creating the conditions for persistent drought in Australia.)

Indeed all of the world's oceans are currently in anomalous states, observations that convinced previously skeptical climatologists that only an anthropogenic signal, superimposed upon natural variability (dominated by atmospheric–ocean oscillations such as the El Niño/Southern Oscillation, the North Atlantic Oscillation and the Pacific Decadal Oscillation), could explain present conditions.

Water issues always warrant greater attention than they receive, since the accelerating hydrological cycle (ocean warming, ice melting, water vapour rising) is exacerbating a suite of crisis-level local problems that threaten hygiene, health, and food production. New data on warming and salmonella infections in New Zealand are discussed, complementing previous data on foodborne outbreaks in Japan during hot summers. But food security and nutrition might have been given more coverage. Pests, pathogens and weeds already consume an estimated 42% of growing and stored crops, and their ranges will change with global warming. But extremes are the real culprits: droughts encourage aphids, locust and whiteflies (vectors of geminiviruses), while floods foster fungi and nematodes. An 1 °C increase in average global temperatures is projected, itself, to reduce rice yields by 10%; and, in 2004, soybean yields in Argentina, Brazil, and

the USA (the three leading producers) were 60% of expected due to severe weather. Model projections and data are moving in tandem — providing mounting “fingerprints” of human influence (together amounting to an unsustainable ecological “footprint” (accordingly we are now using the resources of 1.2 earths; [http://www.ecouncil.ac.cr/rio/focus/report/english/footprint/.](http://www.ecouncil.ac.cr/rio/focus/report/english/footprint/))

The threat to coral reefs from warming is addressed in this work, but separately from the section on food. Loss of reef nurseries, plus algal biotoxins, the 150 hypoxic, non-productive “dead” zones around the world and chemicals — such as mercury emanating from coal-fired power plants and off-shore oil rigs — endanger an essential source of protein for the residents of many nations and an important, healthy source of pleasure and protein for people the world over.

Adaptation to climate change receives extensive coverage. Early warning systems for heatwaves are now in place in some urban centres, thanks to the sustained efforts of some of the authors, along with other researchers, WHO, WMO, and UNEP. Infrastructure will also need reconstruction and — most poignantly — so much is needed to reduce the vulnerabilities of poor nations. Several years ago Jeffrey Sachs proposed that wealthy nations pay reparations for the damages incurred. Such international funds might best be used today as incentives to jump-start the clean energy transition — the first and necessary step towards reprogramming and refinancing sustainable development — a process that can truly buttress public health and reduce vulnerabilities to environmental change.

Developing clean energy technologies could be the best “no-regrets” strategy for our health, or adaptation and for mitigation (i.e. primary prevention). Distributed energy generation, with solar, wind, tidal, wave, geothermal and fuel cells feeding into the power grid (where it exists) — and energy-efficient “green” buildings, improved public transport, hybrid vehicles, along with roof gardens, bicycle and walking paths — will decrease the vulnerability of the grid to storm interruptions and overload during heatwaves. Where grids do not exist, such measures can provide

energy for purifying and pumping water, irrigation, cooking, running computers, radios, lighting and small enterprises (i.e. interventions that directly improve public health).

This attractive, well-written, well-organized and authoritative book on the ongoing and projected impacts of climate change cannot fail to convince even the most cautious public health authorities to adopt the precautionary principle. The informative glossary and extensive index help make this comprehensive volume useful as an introductory text and a reference for those already initiated. Its call to include stakeholders in assessments is pertinent, for public-private partnerships will be needed on micro- and macro- scales to create the infrastructure and craft the scaffolding that builds the global economy and benefits the environment.

Climate change threatens to destabilize the relationships among microbes and other species established over the last 10 000 years (the Holocene epoch), and climate instability and emerging infectious diseases are together stalking wildlife, livestock and crops, and forest and coral reef habitats. This important book highlights the need to place public health at the forefront in reframing the development agenda. ■

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Toman's tuberculosis: case detection, treatment, and monitoring

Editor: T. Frieden

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In the late 1950s and early 1960s developing countries, in particular India, pro-

duced a considerable amount of quality technical and health systems research on tuberculosis. This period, the first golden age of TB research in developing countries, provided the foundation for the national TB control programme. The new policies were gradually shaped in a series of WHO and International Union against Tuberculosis (IUAT) documents to reach the most refined expression in the ninth report of the WHO Expert Committee on TB, published in 1974. Scientists, mainly from developed countries, raised a number of objections, critical remarks and doubts on the evidence supporting the TB control policies. In order to clarify the issues and dispel misunderstandings, WHO and the IUAT commissioned a book to function as a commentary on the scientific knowledge and practical experience underlying the ninth report's policies on TB control for developing countries.

Dr Kurt Toman, a Czech phthisiologist, was selected for this job. Besides being a WHO short-term consultant in TB control for developing countries, he was the Director of the WHO/UNDP International Training Course on Epidemiology and Control of Tuberculosis, held in Prague over three months every year in the 1960s. Seated in a corner of the rostrum, he attended with exemplary discipline all the lectures, which were delivered by a prestigious international faculty, and took note of every question raised by the students with the corresponding authoritative reply. These notes were his main source in writing the book (*Toman's tuberculosis*) and moved him to shape its format as selected Questions and Answers about the technical bases for the policies on case finding and treatment of pulmonary TB. The first English edition was issued by WHO in 1979 and was then translated into French, Spanish, Arabic and Portuguese. *Toman's tuberculosis* soon became the most useful reference publication on the technical basis of the case management strategy for TB control in developing countries.

Although most chapters of the first edition retained their technical validity, there were three important technical features that made *Toman's tuberculosis* out of date by the 1990s: 12-month treatment regimens had been replaced by short-course chemotherapy in which

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rifampicin and pyrazinamide are no longer reserve but first-line drugs; the emphasis on bacteriological diagnosis was reduced in settings with high prevalence of HIV infection; and the emergence of multidrug resistance presented new challenges for its prevention and treatment. DOTS strategy introduced two key innovations over the policies in the ninth report: directly observed treatment is no longer an option but almost a *sine qua non* for treating sputum smear-positive pulmonary TB; and a strict information system should be in place to facilitate monitoring each case under treatment as well as the cohort analysis of treatment outcomes.

Dr Tom Frieden took the initiative to update Toman's book. He has had an almost unique experience in TB control, first as Director of the TB Bureau of New York City in the early 1990s, and later as a WHO Regional Consultant with South-east Asian governments in implementing the DOTS strategy. In producing the second edition of this classic book, he secured the collaboration of 29 contributors from WHO, IUATDL, Centers for Disease Control and Prevention (Atlanta, GA, USA), Tuberculosis Research Centre (Chennai, India), Malawi TB Control Programme, and academic institutions in Belgium, Canada, and the USA.

The second edition has retained 24 chapters of the first edition practically unchanged, keeping Toman's name as author, or have been slightly modified. Some of these chapters are masterpieces of didactic explanations on complex subjects such as those on the sensitivity and reliability of sputum smear microscopy for the diagnosis of TB. Nineteen of the sixty-three chapters in the second edition (twenty-five more than the first edition) are based on Toman's original text but have been updated with relevant information published after 1980. The new edition is divided into three sections (case detection, treatment and monitoring) and greatly expands the scope of the first edition.

The ten chapters on case detection outline the technical basis for the policies currently used to identify and diagnose pulmonary TB, which have remained practically unchanged for 25 years. Brief but useful information is provided on tuberculin tests and the new immunodiagnostic and molecular

biology tests that have not yet been adopted for mass application.

The section on treatment presents the most relevant updated technical information on treatment of new and previously treated pulmonary tuberculosis. New chapters in the second edition deal with extrapulmonary TB, patients with HIV infection, pregnant women, patients with liver or renal conditions, and treatment of latent TB infection.

Section three of the second edition (Monitoring) covers a variety of subjects. Retained and updated are Toman's original chapters on how to supervise and monitor progress of treatment, prevent default, and follow-up cases after cure. Most of the chapters in this section, however, do not deal strictly with monitoring but with management (planning, evaluation and surveillance), epidemiology and research methodology. The title of this section is inappropriate if monitoring is taken to mean the daily activity carried out to verify that the work plans are being implemented as planned. If the objective was to present the evidence base for approaches to diagnosis, treatment and monitoring, the chapters related to nosocomial transmission of TB and other epidemiological topics do not fall within this scope. On the other hand, if the intention was to present an overall picture of the case management strategy extended to prevention and control, as the Introduction states, very important elements are missing, for instance, training and logistics.

The second edition keeps the questions and answers format of the first edition, with all its originality but also with its main weakness, i.e. frequent repetitions despite the many cross-references. Although the editor was careful to avoid contradictions and even different emphases among the 29 contributors, he failed to avoid repetitions. When questions are closely linked, it is hard to provide a complete answer without repeating concepts and facts mentioned in related chapters. Even some chapters overlap considerably, the most evident examples being the reviews on drug toxicity or adverse reactions in chapters 23 and 31 and those on treatment default in chapters 37 and 61. It would have been more straightforward to consolidate many closely related questions into a single composite one. In addition,

the questions and answers format is not necessarily user-friendly; it does not make it easy to find a subject that is not explicitly spelled out in the question. Surprisingly, the book does not include a subject index.

These drawbacks do not, however, detract from the book's quality. Many tables are included and these together with a few graphs help to clarify the issues involved. A number of chapters describe how current knowledge about TB was acquired; the historical perspective is presented in the text and in the citations to the original references, which illustrate how current knowledge about TB was discovered. More importantly, the book reminds us not to believe that TB control can be accelerated merely by increasing financial resources. Programme managers have to learn how to grapple with the many technical details of implementing the case management strategy.

The book is not a substitute for the handy manuals and guides produced by WHO and IUAT. Although it was not intended to be an exhaustive resource, it is a reference book recommended for any professional interested in TB. Certainly, the second edition has restored and renewed the pristine technical value of the first edition. ■

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Tobacco: science, policy and public health

Editors: Peter Boyle, Nigel Gray, Jack Henningfield, John Seffrin, Witold Zatonski
 Publisher: Oxford University Press, Oxford, England; 2004
 ISBN: 0-19-852687-3; 830 pages (hardback); price: £69.50

Tobacco smoke and involuntary smoking (IARC Monographs, Volume 83)

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 ISBN: 92-832-1283-5; 1470 pages (softcover); price Swiss francs 55.00/US\$ 49.50 (Swiss francs 38.50 in developing countries)

Fifty years after Sir Richard Doll first reported results from the British doctors'

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study (1), two encyclopaedic books on tobacco have appeared (2, 3) which document the enormous progress that has been made in research, policy, and actions on global tobacco control. Boyle et al. have synthesized current knowledge of a field that has rapidly matured (2). And the International Agency for Research on Cancer (IARC), in its monograph on tobacco smoke and involuntary smoking, provides extremely detailed evidence from the hundreds of studies that form the basis for our concern about the harms that tobacco causes (3). These books should be compulsory reading for all involved in the control of chronic diseases and more specifically in the control of tobacco.

Both books provide a powerful evidence base for accelerated action against tobacco. Boyle et al. have involved a global “who’s who” list of authors to write chapters that address the mechanisms of addiction and carcinogenesis, the composition of cigarettes and the biological impact of their constituents, the epidemiology of tobacco, key elements of the effectiveness of interventions, and country case studies of policies that have led to less smoking and fewer deaths. The IARC monograph focuses tightly on the carcinogenicity of tobacco products and does so by pulling together all major relevant studies from around the world.

What is striking when reading these massive new tomes is just how much evidence was obtained by Doll and his team over the 50-year period of his cohort study — and how very little new evidence has come to light about the impact of tobacco on human health (with the exception of the impact of second-hand smoke) from the mass of other studies that have been completed over this same period. We do know more about mechanisms of action of tobacco and its products on humans, but until recently that knowledge was not of use to policy-makers. Pricing policies, marketing bans, public-place smoking bans, and high quality educational programmes have not been changed by the new understanding about the mechanisms of disease causation and of addiction.

But now, new scientific information may be of use as tobacco companies increasingly compete with pharmaceutical companies to provide nicotine to people

addicted to tobacco. In 2003, just two companies, Altria and BAT, spent over US\$ 500 million on new product development and are seriously gearing up to make new offerings to the public. The public health community will have to use its best knowledge to judge whether dramatically reduced exposures from new tobacco products will translate into fewer deaths and less disease well before a further 50 years of cohort studies have been completed. This will require using better biomarkers of exposure and outcomes, and simultaneously will require greater wisdom about how to communicate results to the public in such a way that “new products” do not lead to a slow down in smoking cessation rates or to continued smoking among youth. Several authors in the book by Boyle et al. correctly identify the need for urgent support to be given to cessation programmes as the principal means, together with smoke-free policies, of reducing death rates from smoking over the next two decades. The complexity of this looming debate about nicotine supply is mentioned a few times in the book without proposing a bold way forward.

A weakness of the book by Boyle et al. is that it does not explicitly address the many aspects of the globalization of tobacco marketing, trade and now control. Individual country reports are useful, but the real progress from a global perspective has arisen from the recognition that there are limits to national action in trying to control cross-border marketing, trade, investment and smuggling, and instead to attempt to promote cross-border learning about effective interventions. The WHO Framework Convention on Tobacco Control (FCTC) does, however, address these issues. It is very briefly mentioned in the book by Boyle et al. It would be helpful to discuss how the very process of building global consensus for the FCTC meant that nongovernmental organizations, governments and UN agencies needed to find areas of agreement where previously there had been none; and that every working group and major meeting was regarded by the 1000 or so participants as a “global university of tobacco control”, which facilitated sharing of best practices in a unique manner. The FCTC process galvanized global action like never

before, attracted new funding, and built coalitions that remain active 5 years after their formation.

These two books thus appear at a time when governments and tobacco control advocates are hungry for evidence of what to do to make a difference. The epidemiological studies will continue to inspire them but the following are increasingly needed if progress on paper is to lead to meaningful change:

- serious investment by all governments in tobacco control and greater use of excise tax to fund this;
- budget lines for tobacco control that are explicit and prioritize the FCTC elements priorities;
- when the above two are in place, the international donor community needs to make good on the pledges it made in the lead-up to the adoption of the FCTC. This includes the European Commission, which pledged to support tobacco control in developing countries; many foundations, some of which were active funders between 1999 and 2003 and have since reduced their support for international tobacco control; and The World Bank and regional development banks, which as a group are still not supporting tobacco control in proportion to the public health gains that investment could bring.

The country reviews in the book by Boyle et al. show that when committed people with passion and competence tackle tobacco control, much can be achieved. To sustain the progress and to expand it will, however, take a significant and needed increase in funding, and also a new infusion of leadership for tobacco control led from developing countries. IARC’s new approach to tobacco control may well start addressing these issues by providing the tools needed to ensure that 50 years from now we have books released detailing the decline of an entirely preventable, costly and painful epidemic. ■

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Web version only, available at: <http://www.who.int/bulletin>

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