

Dealing with global health threats — including emerging infectious diseases such as SARS, behavioural risk factors such as tobacco use, and chronic disease — together with other challenges such as injury prevention and environmental health, requires considerable technical capability and experience. Many countries have found the critical mass of skills and knowledge that can be developed in a national public health institute (NPHI) to be crucially important in dealing with health problems on a population and community basis. A group of NPHIs met in 2002 and 2004 to plan ongoing collaboration that focuses on common public health concerns.

Improving the world's health through national public health institutes

Jeffrey P. Koplan,¹ Pekka Puska,² Pekka Jousilahti,³ Kathy Cahill,⁴ Jussi Huttunen,⁵ & National Public Health Institute partners⁶

Globalization is as applicable to health issues as to those of trade and economics (1). The increased frequency of travel, distribution of goods, migration, spread of communications and marketing of new lifestyles have promoted a set of risks and health challenges shared by all countries of the world, despite their varied resources, levels of development, demographics and other important considerations (2). The ability of any one country to solve these new challenges on its own is increasingly difficult and certainly inefficient.

In many countries, health authorities have established scientific entities that serve as national resources to prevent and control health problems through research, interventions or the development of policies. There is an increasing tendency to merge these entities and develop more comprehensive public health institutes to deal with the various issues from a public health perspective. We describe the current nature and status of such national public health institutes (NPHIs) and consider the elements that might make them increasingly effective in preventing disease and promoting health in an increasingly interdependent world.

An NPHI is an organizational unit of a national government health ministry (not of a state or province), which serves the whole country as a source of technical public health expertise and would be the unit called upon to respond to public health

threats. The institutions listed in the co-authorship of this paper were selected by their ministries of health as meeting these criteria, although in some countries several organizations share roles and responsibilities for different health threats. The distinct, complementary entity of an NPHI is symbiotic with other functions of a ministry of health. Where the ministry is responsible for overall policy, legislation, budgets, curative programmes, etc., the NPHI can provide expert advice and carry out public health programme implementation, disease and risk factor monitoring and surveillance, outbreak investigations, research, and health promotion and education. Advantages of the NPHI include the assembly of a stable mass of expertise, continuity of experience, and the scientific knowledge and appropriate human, technical and financial resources to tackle public health challenges; it is a scientific organization without political affinity.

The oldest of the participating institutes is Brazil's FIOCRUZ (established in 1900); Finland's KTL is over 90 years old, and the CDC in the United States, is over 50 years old. An institute was established in Bosnia and Herzegovina in 1999 and the Chinese Academy of Preventive Medicine was reorganized and renamed as the China CDC in 2002. The size of the institutes varies greatly, from a few hundred workers (Algeria 140 and Pakistan 250) to several thousand (Brazil 6500, China 2400 and the United States 8000).

¹ Vice-President for Academic Health Affairs, The Robert W. Woodruff Health Sciences Center, 1440 Clifton Road NE, Suite 410, Emory University, Atlanta, GA 300322, USA. Correspondence should be sent to this author (email: jkoplan@emory.edu).

² Director-General, Kansanterveyslaitos Folkhälsöinstitutet (KTL) [National Public Health Institute], Helsinki, Finland.

³ Scientist, KTL, Helsinki, Finland.

⁴ Senior Advisor for Strategy and Innovation, Centers for Disease Control and Prevention, Atlanta, Georgia, USA.

⁵ Past Director-General, KTL, Helsinki, Finland.

⁶ Participants in a meeting of Director-Generals of National Public Health Institutes, Bellagio, Italy, October 2002: Gunnar Agren (National Institute of Public Health, Sweden), Paulo Buss (FIOCRUZ, Brazil), Tim Evans (Rockefeller Foundation, USA), Igor Glasunov (National Research Centre for Preventive Medicine, Russian Federation), Oni Idigbe (Nigerian Institute of Medical Research, Nigeria), Amanullah Khan (Institute of Public Health, Pakistan), Li Liming (Chinese CDC, China), Malegapuru William Makgoba (University of Natal, South Africa), John Mathews (Department of Health and Ageing, Australia), Alirza Mesdaghinia (Institute of Public Health Research, Islamic Republic of Iran), Carole Moquin-Patthey (INSERM, France), Alex Papilaya (University of Indonesia), Dirk Ruwaard (National Institute for Public Health and the Environment, the Netherlands), Pathom Sawanpanyalert (National Institute of Health, Thailand), Jaime Sepulveda (Instituto Nacional de Salud Publica, Mexico), Pavel Urban (National Institute of Public Health, Czech Republic), Zlatko Vucina (Federal Public Health Institute, Bosnia and Herzegovina), and Noureddine Zidouni (National Institute of Public Health, Algeria). Additional participants representing other national public health institutes in the July 2004 meeting in Helsinki, Finland, were: Marijan Erceg (Croatia), Paul Gully (Canada), Maarike Harro (Estonia), Miph Musoke (Uganda), Maggie Rae (United Kingdom), Marija Seljak (Slovenia), and Hideo Shinozaki (Japan).

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The scope of public health activities of each institute also varies but most of them work on infectious diseases — including immunizations, vital statistics, health promotion, chronic diseases and risk factor surveillance — environmental health and safety, and health services research. Some of the institutes have academic roles; for example, the NPHI of Mexico (Instituto de Salud Publica) educates students enrolled in masters and doctoral degrees. All the institutes have varying emphasis on research, service and regulation. Some, such as Mexico's ISP and France's INSERM, are predominately research focused. If service or the promotion of health is the primary mission, considerable research, mostly applied, is performed to direct and improve that service, e.g. Finland's KTL, the US CDC and Brazil's FIOCRUZ. Many have a major research focus and a supplementary service role, as at the China CDC.

Almost all the NPHIs are supported by their national government in the form of an annual budget, the amounts being a reflection of the size and overall income and expenditure of each country and also the roles that the institute is expected to play. Thus some institutes (e.g. in Sweden and the United States) channel financial support for domestic programmes, with or without technical advice, through local health departments (city, provincial and state), other academic institutions and community organizations. Most of the institutes are responsible to the ministry of health of their national government; some are housed in a university setting.

Core functions of NPHIs

Most of the NPHIs represented in Bellagio and Helsinki had many common elements. Although of varying size and service provision, each had a core set of fundamental functions that determined its ability to respond to health emergencies and promote disease prevention activities. The desirable core capacities described below will be important contributors to ensuring health in the 21st century.

Research

Research is needed to create a firm knowledge base in order to anticipate future trends, needs and challenges, taking account of direct indicators of health and also structural, behavioural and social determinants. The primary goal of research carried out in an NPHI is promotion of health and reduction of the risks of diseases of public health importance. Information on the health and health determinants of the populations and on the prevalence of risk factors is necessary for the formulation and implementation of health policy. The research function can also involve the assimilation of knowledge generated by other investigators and in collaboration with universities and other partners.

Monitoring and surveillance

Monitoring of the health status and health determinants of population groups is a crucial function of the NPHIs. Collection of data and monitoring of disease trends and determinants, however, are not enough: health information must be easily accessible to policy-makers, health professionals, the media and the general public, all of whom need to make informed decisions on policies and personal health choices. The information should be available via electronic media and should be published regularly in publicly accessible form, in order to promote an informed debate concerning health policies and actions.

The core surveillance functions should include: development of health indicators, surveillance of health and health

determinants, data analysis, periodic systematic reports and dissemination of information to public health workers, government leaders and more broadly. Core monitoring should concern at least the infectious and chronic diseases and risk factors that threaten health or the services that are major determinants of health status within the country diseases.

Data can be collected from a variety of sources at local and national levels by telephone, mail, in person and by examination. Data can be regulated by health services or collected by special population surveys, which can vary from relatively simple interviews regarding health behaviour and preventive practices to field surveys of risk factors and more comprehensive health examinations. Behavioural risk factor surveillance has increased in recent years, as it has been found to be a very valuable tool for disease prevention and health promotion programmes (3).

Control of infectious diseases

In every country the burden and threat posed by infectious diseases calls major public attention to the prevention and control of epidemics, which is usually one of the functions of NPHIs. The development and implementation of surveillance programmes, epidemiological investigation, standardized laboratory procedures and practices, technical expertise, and support to local and regional health authorities are all important responsibilities of the NPHI. Many institutes are also involved in implementation of national immunization programmes, including purchasing and distribution of vaccines and monitoring of coverage.

Chronic noncommunicable diseases

Global health issues and the field of public health are in rapid transition. According to *The world health report 2002*, some 60% of all deaths in the world are attributable to chronic noncommunicable diseases, about half of which are cardiovascular diseases (2). The increase in this global burden is a result of the rapid expansion of risk factors for noncommunicable diseases caused by lifestyle changes, especially in the developing countries.

Following these developments, NPHIs, especially in the developed world, are paying increased attention to chronic diseases and their determinants. Priority concerns include surveillance but also research and various public health functions, including health promotion and health education. Several NPHIs work on nutrition and tobacco-related projects.

Emergency preparedness

Major epidemics, terrorism, environmental health disasters, natural disasters and other public health emergencies require a public health system that is responsive and capable of delivering emergency services to the population affected. Routine monitoring of infectious diseases, combined with an effective outbreak investigation system, form the foundation of response to a threat or disaster.

Core functions should include: national and regional comprehensive emergency response plans that are regularly tested; epidemiological expertise in disease investigation and specific biological agents, e.g. anthrax and plague (if not available in the country, the possibility of support from other NPHIs or WHO is critical); effective communication systems that provide access to the media, the public health system and health-care providers for the dissemination of information; and cross-training to provide a multiskilled public health workforce for use in an emergency.

Diagnostic services

Core capacities for public health laboratories will depend upon the needs and functions of each country's health-care delivery structure. Many NPHI laboratories coordinate national screening programmes, particularly in maternal and child health care (e.g. prenatal screening) and serve as a reference or have a consultative role in relation to other private or public health system laboratories.

Core functions should include: control of laboratory standards and quality of public health laboratory services; ensuring that public health laboratory functions are available within the country for routine infectious diseases, chronic disease and environmental health diagnostics; and provision of laboratory training for the public health workforce, e.g. local and regional public health laboratory technicians.

Health promotion and health communication

Most NPHIs participate in some way in disseminating health information to the public, as public attitudes towards health promotion and the prevention of disease are critical for the success of health campaigns and the implementation of health policy. The media also play a key role in delivering health messages and influencing health policy. In a global environment, the media can obtain information faster than individual NPHIs and it is therefore important that NPHIs have a communications network (e.g. an Internet web site) for sharing information, especially in emergency health situations.

Core functions should include: health communications expertise to provide health messages to diverse populations; implementation of evidence-based health programmes, specifically targeted as determined by public health surveillance and assessment; development of key coalitions and partnerships involving policy-makers and other stakeholders (e.g. health services, civil society, private sectors and the media) to promote health and influence public opinion; and building new communication linkages to disseminate health information, e.g. Internet web sites.

Training and education

Training to create a competent workforce in public health takes place with the overall education and training system of the country and in collaboration with schools of medicine and public health; the role of NPHIs varies. There are two types of training needs. The first is for a public health workforce of health-care professionals and others on disease-specific and technical and scientific aspects (epidemiology, laboratory work, etc.). The second type of training is development of a public health workforce that has a set of core competencies applicable to all public health professionals; this focuses on delivering MPH programmes, developing basic management, evaluation, and scientific training, and ensuring that the workforce is cross-trained in many different public health competencies.

Collaboration and challenges

Many of the NPHIs have collaborative relationships with sister institutes (US CDC and China CDC), international organizations (WHO, UNICEF and The World Bank), universities, non-governmental organizations and professional societies. These partnerships may involve broad memoranda of understanding or very specific collaboration around a particular health issue or research project.

Although NPHIs vary in their roles and functions, the value, service and credibility they add to the ministry of health and their country are significant. While an NPHI of the 1950s would have consisted primarily of infectious disease epidemiologists, laboratory technicians and administrative staff, the present-day NPHI has a mix of public health professionals with skills in laboratory science, research, health promotion, nutrition, behavioural and social science, economics and communications technology.

From the many different models of NPHI, they all have the capacity for research, public health expertise, health monitoring and service delivery, though the breadth and depth of these functions may vary. New health challenges demand intense intellectual ability combined with practical know-how and the capacity to respond quickly with laboratory and epidemiological investigative capacity in order to control the consequences of terrorism and unintentional infectious disease outbreaks. At the same time, an NPHI is expected to make major contributions to prevention of chronic noncommunicable diseases that constitute the major and increasing burden of diseases in most countries (4). Combining research functions and service provision ensures a strong response capacity to any type of emergency or delivery of public health programme.

The rapid spread of emerging infectious diseases such as SARS, the increasing use of tobacco in the developing world, changes in the environment, ageing of the population, changing diets and other lifestyles, and the increasing impact of chronic diseases will challenge NPHIs and create a demand for the establishment of new NPHIs in countries where they do not already exist (5, 6).

It is important for ministries of health around the world to be able to respond to health-threatening situations rapidly and effectively, using the best public health interventions available. Management systems, including information technology, will become even more important worldwide. The linkage of information and surveillance systems for detection and control of communicable diseases will be increasingly in demand by politicians and the public in order to protect populations from threats of terrorism or disease.

Policy development is crucial to improving environments and helping individuals to make healthier choices: smoking bans, seat-belt use, environmental clean-up, nutrition programmes and community design are examples of the policy tools needed by NPHIs. Improving health will include treatment and curative options along with preventive ones, but is highly dependent on sound policies and a mix of feasible public health strategies.

In the future there will be an increasing need to look at public health issues across many different diseases and functions (7). The effect of infectious diseases on chronic diseases, for example, and the genetic revolution will have a major impact on public health delivery and research. NPHIs must be prepared to cope with technological changes as well as disease prevention and control, so a critical mass of experts and public health capacity as demonstrated in NPHIs will be important.

The Bellagio meeting was the first time that NPHIs of the world came together to share common experiences, discuss opportunities for collaboration, and form a network. In 2004 the group reconvened and declared its intention to establish an International Association of National Institutes of Public Health, with a secretariat located at KTL in Helsinki, Finland. Modalities for this organization are being developed; they

will include mechanisms for swift and clear communication between the members, joint training activities, collaborative research projects, and mutual assistance on a wide variety of public health issues such as surveillance and outbreak investigation. In an increasingly globalized world, international collaboration between NPHIs is vital for success in any country and for global public health. The shared vision of the NPHI participants will now be put into operation through an association that facilitates partnership and collaboration. We believe this collaboration will improve public health throughout the world and be a legacy for future generations of public health professionals. ■

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Missing deaths from pesticide self-poisoning at the IFCS Forum IV

Flemming Konradsen,^{1,2} Wim van der Hoek,² David Gunnell,³ & Michael Eddleston⁴

Since the middle of the last century, pesticides have become an integral component of the world's attempt to increase agricultural output and decrease vector-borne disease. However, the benefits of pesticides have come at a cost and their continued use is the frequent subject of debate.

The Intergovernmental Forum on Chemical Safety (IFCS), established in 1994 following the recommendations of the United Nations Conference on the Environment and Development (UNCED, the Earth Summit), was charged with identifying priorities for action on chemical safety and reducing the hazards associated with chemical use (1, 2). IFCS takes the position that substantial use of pesticides is essential to achieve sustainable development. It attempts, however, to find strategies to mitigate the adverse effects that pesticides may have on human health and the environment (1, 3).

IFCS's first meeting provided policy guidance and integrated strategies for implementation of the key areas that were adopted by UNCED in Agenda 21 (1, 2). Its subsequent meetings have evaluated the progress that has been made. In 2000, at Forum III, IFCS adopted the Bahia Declaration on Chemical Safety, which identified key goals with target dates for their achievement (4). This declaration was later endorsed by the United Nations Environment Programme (UNEP) Governing Council and forms an important basis for international efforts to manage chemical use. The most recent meeting — Forum IV — took place in Bangkok in November 2003 (5). Major topics for discussion included the safety of children, occupational safety and health, capacity building in the developing world, and acutely toxic pesticides.

This last subject is of particular concern. Since a report from WHO and UNEP in 1990 (6), the scale of the problem

caused by acutely toxic pesticides has been readily apparent. The report estimated that more than 3 million people were hospitalized for pesticide poisoning every year and that 220 000 died; it particularly noted that two-thirds of hospitalizations and the majority of deaths were attributable to intentional self-poisoning rather than to occupational or accidental poisoning.

Recent studies from Asia suggest that as many as 300 000 deaths from pesticide self-poisoning may occur in the Asia-Pacific region every year (7, 8). The easy availability and lack of safe storage of pesticides in the homes of the rural poor mean that many acts of self-harm, at moments of acute distress, have fatal and sometimes unintended consequences (8, 9).

Official documents from Forum IV invite assistance in the identification of gaps in the proposed strategies for chemical safety (3). Similar to many previous initiatives aimed at reducing the adverse effects of pesticides, the obvious gap is that there is no mention of the hundreds of thousands of deaths from pesticide self-poisoning that occur each year. Instead, the effort was directed towards occupational poisoning. IFCS appears to be overlooking the evidence on major pesticide mortality: a visit to any rural district hospital in Asia will demonstrate the enormity of the problem. A prospective study in Sri Lanka including 2257 poisoned patients admitted to two peripheral hospitals found that more than 95% of the patients with pesticide poisoning were cases of self-poisoning (Eddleston, submitted).

A working group was set up by Forum III to: "provide initial input on the extent of the problem of acutely toxic pesticides, and provide guidance for sound risk management and reduction, including options for phasing out where appropriate, and report to Forum IV" (10). It would seem reasonable — since pesticide self-poisoning is responsible for so many

¹ Department of International Health, Institute of Public Health, University of Copenhagen, Blegdamsvej 3, 2200 Copenhagen, Denmark. Correspondence should be sent to this author (email: f.konradsen@pubhealth.ku.dk).

² International Water Management Institute, Colombo, Sri Lanka.

³ Department of Social Medicine, University of Bristol, Bristol, England.

⁴ Centre for Tropical Medicine, Nuffield Department of Clinical Medicine, University of Oxford, Oxford, England, and Department of Clinical Medicine, University of Colombo, Colombo, Sri Lanka.

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deaths — to include self-poisoning in the report, but the working group was asked to consider poisoning of pesticide users only, excluding self-poisoning, despite most self-poisoning deaths occurring in the farming communities that buy and use pesticides (8). Consequently, self-poisoning was not discussed in Forum IV.

There is scope to consider this matter within the Forum since pesticide self-poisoning was not excluded from its first report (1). Most health problems related to pesticides in many Asian countries follow self-poisoning, suggesting that they should be included in both the review and IFCS action. Furthermore, the original declaration from the Earth Summit covered all forms of poisoning, stating that “areas of risk reduction encompass the ... prevention of poisoning by chemicals”, not just occupational and accidental poisoning (2, section 19.46).

If the strategies and policies outlined in the IFCS Forum IV declaration are implemented, there is likely to be a reduction in the morbidity associated with occupational pesticide poisoning. A number of the actions proposed — phasing out the most toxic chemicals, promoting alternative pest management strategies, and improving safe storage — are also likely to have an effect on the number of self-poisoning cases (11). Nevertheless, the subject of self-harm needs to be dealt with directly: a strategy aimed specifically at preventing self-poisoning would differ in emphasis from a strategy to reduce occupational poisoning. Since self-poisoning results in far more serious illness than occupational poisoning, the capacity for treatment at health facilities in resource-poor countries must be improved (8, 12). Provision and correct use of effective antidotes in small rural health centres and ventilators in district hospitals, together with the development of evidence-based guidelines, will reduce the number of deaths that occur after presentation to hospital.

Clearly, the issues of self-harm are psychosocially, economically, culturally and politically complex and go beyond the question of pesticides. Prevention campaigns combining social and mental health sectors with the agricultural sector may have an impact on cases of severe poisoning and excessive mortality. In international treaties, there is need for explicit inclusion of self-poisonings in risk assessments, with development of recommendations for restrictions of sales and marketing of particular formulations and concentrations (13, 14).

We call upon IFCS to recognize that globally most pesticide deaths occur following self-poisoning. Self-poisoning needs to be acknowledged as a major problem of chemical safety — one that affects pesticide-using communities in the developing world and one that can be reduced with concentrated effort (8, 11). Perhaps greater involvement of WHO and ministries of health, not just ministries of agriculture or environment, in drawing up treaties such as the Rotterdam Convention (15) will improve understanding of these important health issues. ■

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