Enhancing regional capacity in chronic disease surveillance in the Americas

Bernard C. K. Choi,[1] *Stephen J. Corber,*[2] *David V. McQueen,*[3] *Ruth Bonita,*[4] *Juan C. Zevallos,*[3] *Kathy A. Douglas,*[5] *Alberto Barceló,*[2] *Miguel Gonzalez,*[6] *Sylvia Robles,*[2] *Sylvie Stachenko,*[1] *Mary Hall,*[3] *Beatriz M. Champagne,*[7] *M. Cristina Lindner,*[8] *Ligia M. de Salazar,*[9] *Ricardo Granero,*[10] *Lourdes E. Soto de Laurido,*[11] *Washington Lum,*[12] *Rogger E. Torres,*[13] *Charles W. Warren,*[3] *and Ali H. Mokdad*[3]

Key words: chronic disease, surveillance, epidemiology, Americas.

[1] Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada, Government of Canada, Ottawa, Ontario, Canada. Send correspondence and reprint requests to: Bernard C.K. Choi, Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada, P.L. 6701A, 120 Colonnade Road, Ottawa, Ontario, Canada K1A 1B4; e-mail: Bernard_Choi@phac-aspc.gc.ca
[2] Disease Prevention and Control, Pan American Health Organization, Washington D.C., United States of America.
[3] National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Department of Health and Human Services, Atlanta, Georgia, United States of America.
[4] Evidence for Information and Policy, World Health Organization, Geneva, Switzerland.
[5] Progamme Evaluation and Monitoring, Department of Noncommunicable Diseases and Health Promotion, World Health Organization, Geneva, Switzerland.
[6] Americas' Network for Chronic Disease Surveillance, Santa Fe de Bogotá, Colombia.
[7] InterAmerican Heart Foundation, Dallas, Texas, United States of America.
[8] Non-Communicable Diseases, Ministry of Public Health, Montevideo, Uruguay.
[9] Public Health Evaluation Centre, University of Valle, Cali, Colombia.
[10] Ministry of Health and Social Development, Barquisimeto, Venezuela.
[11] Research Institute for Global Health Promotion and Health Education, University of Puerto Rico, San Juan, Puerto Rico.
[12] Ministry of Health, Panama, Republic of Panama.
[13] Non-Communicable Diseases, Ministry of Health, Lima, Peru.

There is a sense of urgency in the need to enhance the capacity for surveillance of chronic diseases (or non-communicable diseases, NCD) in the Americas (the Region) (1). This need is driven by several factors.

First, the epidemiological pattern in the Region is undergoing a transition from infectious diseases to chronic diseases. The rapidly changing burden of disease is mainly due to decreasing fertility, an aging population and changing lifestyle behaviors. All countries face an increasing burden of chronic diseases, regardless of their stage of economic development (2). Chronic diseases are now the greatest health problems not only in developed countries, but also in the developing world (3). Indeed, the vast majority of deaths from chronic disease (78%) occur in the developing world (4). In the Americas, chronic diseases are responsible for two out of three deaths (5). As a result there is a need to document, through surveillance, the changes in the chronic disease picture in order to improve preventive and control strategies (6).

Second, while chronic diseases are noncommunicable at the disease level, the associated risk factors are transferable (7). Mass migrations from rural to urban areas and across countries expose host populations to new risk factors for chronic diseases, such as acculturation, stress, and changes in diet and physical activity. For example, according to the Ecuadorian National Institute of Statistics and Census, in only 3 years more than 10% of the population had left Ecuador (8). Thus there is a need for regional surveillance capacity to curb the epidemic of chronic disease risk factors in the Americas.

Third, two critical social factors that are impacting the Region directly affect the changing pattern of chronic diseases. The first is the impact of globalization and a globalized economy—which mean the increasingly rapid movement of goods and workers across borders. This movement, in turn, changes disease risk patterns while at the same time radically altering the risk factor patterns associated with diseases. Unhealthy lifestyles are communicated worldwide through television, movies, magazines, and the Internet. The second factor is the rapid shift in most countries to an increasingly urban context of life. This urbanization not only produces changes in environmental structures, but also exposes a previously rural population to unfamiliar risks and challenges in the conduct of everyday life.

Fourth, the capacity of chronic disease surveillance is uneven in the Americas (9, 10). Industrialized countries such as the United State of America (USA) and Canada have developed capacities to conduct surveillance and implement policies to address chronic disease prevention and control. But ministries of health in developing countries are increasingly turning to the World Health Organization (WHO) for advice on the control of emerging heart disease, cancer, and injury epidemics (11). Many countries in Latin America and the Caribbean do not have published data on even basic surveillance information such as the prevalence of the major risk factors which predict key chronic diseases.

Finally, most countries in Latin America and the Caribbean lack the resources and expertise to conduct chronic disease surveillance. Poverty levels Region-wide were 35% in 1980, 41% in 1990 and 39% in 2000 (12). One out of six families in Latin America and the Caribbean cannot meet basic dietary needs, even if all of their household income were spent on food (13). In addition to chronic diseases, these countries continue to suffer from the traditional burden of infectious and parasitic diseases. In 1991 cholera returned to the Region, where obesity, diabetes and other chronic diseases are already epidemic.

International health agencies, the governments of the various countries, nongovernmental organizations (NGO), and public health professionals and practitioners have done a lot of work to build and enhance the capacities in chronic disease surveillance in the Region. There is a need at this time to summarize and promote successful experiences in order to further enhance and speed capacity-building in the Americas.

The objectives of this paper are to call attention to the need to improve chronic disease surveillance in the Region, to present an overview and summary of the activities and issues in chronic disease surveillance in the Americas, to document a list of resources and references for readers to obtain further information on activities of interest, and to provide recommendations for enhancing regional capacity-building. This paper is not meant to be exhaustive or to represent the official positions of any country, national or international organization. It is based on a personal review of some of the pertinent literature relating to activities in enhancing the chronic disease surveillance capacity in the Americas, and the authors' own participation in various projects, meetings, conferences and networking experiences in chronic disease surveillance in the Region. Materials reviewed included documents, reports, websites and personal notes from various projects, events and activities. Results were grouped according to the perceived need by the authors based on the materials reviewed. The discussion was based on an in-depth analysis of the materials collected.

In this paper, surveillance is defined as "tracking and forecasting any health event or health determinant through the ongoing collection of data, the integration, analysis and interpretation of that data into surveillance products and the dissemination of that resultant surveillance product to those who need to know" (14). Chronic disease is defined as "disease that has a prolonged course, that does not resolve spontaneously, and for which a complete cure is rarely achieved" (15).

Our review identified a number of activities to enhance the capacity of chronic disease surveillance in the Americas, including activities that take place elsewhere but which have an impact on capacity-building for surveillance activities in the Region.

Pan American Health Organization activities

As an agency of international advocacy and health promotion and a WHO Regional Office for the Americas, the Pan American Health Organization (PAHO) has a mandate to provide technical cooperation to countries in the Region, and works closely with the ministries of health of the 35 member states in the Americas in designing programs to improve health and reduce health inequities throughout the Region (9). PAHO has published important reports for Latin America and the Caribbean on the status of NCD risk factors, health situations and trends (16), as well as the prevalence of hypertension (17) and the prevalence of diabetes (18).

PAHO has conducted country-based surveys to identify issues and gaps in chronic disease surveillance in the Americas. A 1996 PAHO survey on health information infrastructure in 24 countries in the Region revealed serious inadequacies and varying capacities in data gathering, information dissemination, and human resource training (10). Another PAHO study found that a number of one-time surveys on risk factors had been conducted in various countries. These surveys were carried out by different groups even within the same country, studied different populations, and measured variables in different ways. That is, risk factor surveys had not been standardized (9).

After the need for the development of standardized risk factor surveys was identified as a priority for Latin America and the Caribbean, work began in 2000 in two areas: development of indicators and a validated measurement tool which could be used and adapted by member states (19), and as-

sessment of existing activities in countries to determine which technical aspects needed improvement (17). In developing the indicators for PAHO, 30 experts from Latin America and the Caribbean participated in two rounds of consultation using a Delphi method. The resulting standard questionnaire with core and optional questions is available on the PAHO website (20). To assess existing activities, PAHO developed an evaluation tool. Nineteen questions on six technical aspects were used to assess the quality of the survey data in 209 reports on risk factor surveys in 19 countries in Latin America and the Caribbean. The results of this evaluation indicated a growing interest in NCD risk factors as shown by the increase in the number of risk factor surveys in recent years (9).

The Pan American Health Organization also promotes training courses and provides information support in chronic disease surveillance for the Region. The most recent PAHO chronic disease surveillance workshop was held in November 2003 in Rio de Janeiro, Brazil. During the same month, PAHO also established a Virtual Health Library for Non-communicable Diseases to promote free and democratic access to scientific information as well as the sharing of experiences among experts (21).

Since 2000, PAHO, in collaboration with the U.S. Centers for Disease Control and Prevention (CDC) and several countries from Central America, created the Central America Diabetes Initiative (CAMDI) to collect survey-based data on NCD risk factors in Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua (22). This initiative uses the standardized questionnaire and methods developed by PAHO and adapted for Central America from the WHO STEPwise approach (23). Guatemala published survey results in 2003, Honduras and Nicaragua started collecting data in 2003, and Costa Rica and El Salvador initiated their surveys in 2004. When fully operational, CAMDI is expected to evolve into a continuous risk factor monitoring system, the Surveillance of Risk Factors (SuRF) system.

Another PAHO activity in chronic disease surveillance started in 1999 in the area of occupational sentinel health surveillance, to address the problems of a lack of reliable surveillance information, difficulties in the diagnosis of occupational diseases, and problems with the notification systems. The first phase started with the 1999 Washington workshop in the USA (24). Twenty-four experts from 13 countries in the Region were invited to prioritize and select sentinel health events, and to develop surveillance protocols. Phase 2 led to publications, pilot projects, software development, electronic communication, and meetings. Phase 3 activities took place at the 2000 Rosario Meeting in Argentina, which established a Virtual Regional Center for Latin America. Currently this project is in Phase 4, which involves a number of further activities aimed at achieving the Center's objectives (25).

World Health Organization activities

In 2000 WHO developed a STEPwise approach to surveillance of NCD risk factors (STEPS) to improve the quality of data being collected by countries in low-resource settings and to allow data comparability over time within and between countries (26). This approach to chronic disease risk factor surveillance comprises a simple, standardized method for data collection, analysis and dissemination that involves three steps of increasing complexity: questionnaires (tobacco use, alcohol use, intake of fresh fruit and vegetables, physical activity) in Step 1, physical measurements (weight/height/waist circumference, blood pressure) in Step 2, and biochemical assessment of blood samples (cholesterol, blood sugar) in Step 3 (23). The STEPS approach highlights the importance of risk factors as indicators of future health status, as "risk factors of today are the diseases of tomorrow" (2, 27). It also provides guidance on key methodological issues in surveillance as well as encouraging the collection of core or minimal data on the eight major risk factors mentioned above, which have been identified as the greatest contributors to the burden of disease (28). Advice and training are offered on the use of a standard questionnaire, sampling and sample size, response rate, quality control, data analysis, cost and infrastructure (2). The WHO STEPS system was designed to be flexible and able to incorporate additional measures of local interest by encouraging the use of expanded questions as well as optional modules. The STEPS approach simplifies and promotes collection of country-level data on a set of common, measurable chronic disease risk factors with a common set of methods, including a minimum sample size for a basic surveillance site of 2000 men and women aged 25–64 years. The World Health Organization also provides a series of workshops to assist country and regional staff in planning, implementing, analyzing and using data, and in building capacities to use the STEPS methods (29). Because STEPS is more suited to low-income countries, there is some potential for PAHO member countries who are not involved in the more comprehensive CARMEN initiative (*Conjunto de Acciones para Reducción Multifactorial de Enfermedades No Transmisibles*, a WHO regional chronic disease network for the Americas) (30, 31) to start their data collec-

tion efforts with this basic approach. Detailed protocols and manuals for supervisors, field workers, data managers and analysts are available, together with reporting templates for data transfer and advocacy (29).

In recognition of the need to bring together in one place the vast array of information already collected by countries on the eight major risk factors mentioned above and to act as a warehouse for the data emerging from the various noncomparable surveillance activities undertaken by different networks, the WHO Global InfoBase was developed in 2002. The InfoBase is a relational data base that assembles, in a transparent manner, all available country-level data on chronic disease risk factors, together with details of the source and features of study design. It is able to generate country profiles and regional or global reports on the status of these risk factors. In 2003 a training manual and training process were developed to assist handover of the InfoBase to the WHO Regional Offices (32). Thus the Global InfoBase is a network of the six WHO Regional InfoBases. The key feature of the InfoBase is that all metadata are available without the user having to refer to the original source publication. The InfoBase also has templates for the entry of source, survey and risk factor data, and ensures that data cannot be entered without full information about the source contact and survey information. Often individuals interested in using risk factor data lack access to necessary journals or other data sources. The InfoBase has therefore been designed as a "one-stop" resource for these data needs. InfoBase search and data display tools allow the user to preferentially select sources or surveys from the data search form and display this data as a country profile (33).

The first application of this tool was the production of the first SuRF report (Surveillance of Risk Factors Report 1), which displays data on the prevalence and mean values for the eight major risk factors in all WHO Member States for which such data exists (34). The second report, SuRF Report 2, will publish the results of the harmonization of existing country-level data to allow comparison within and between countries for selected risk factors. The third step will be to map the data. Together with the Virtual Health Library for NCD (21) developed by PAHO, this major research tool will improve access to quality health information for all health practitioners and researchers in the Region.

Brazil, Mexico, and the USA, the three countries in the Americas each with a total population exceeding 100 million, are part of the Mega Country Health Promotion Network (35). The Network was formed by WHO in 1998 in response to critical transnational health issues and the transition of the global disease burden from communicable to non-communicable diseases. Brazil, Mexico, and the USA, together with eight other Mega countries from other WHO regions, constitute over 60% of the world population. Comparison of chronic disease surveillance systems across these 11 Mega countries has yielded important lessons concerning effective partnership models, data collection methods such as telephone surveys versus face-to-face interviews, and other aspects of relevance in adapting surveillance systems from developed countries to developing countries (36).

WHO, in collaboration with the CDC, developed the Global Tobacco Surveillance System (GTSS) in 1999 to assist all 192 WHO Member States in collecting data on youth and adult tobacco use (37, 38). This activity has had an effect on a regional level as well as on a global level. The GTSS is a flexible system that includes common data items but also allows countries to include important unique information at their discretion. It uses common survey methods, similar field procedures for data collection, and similar data management and processing techniques. The GTSS includes collection of data for young people through the Global Youth Tobacco Survey (GYTS), and for adults through the Global School Personnel Survey (GSPS) and Global Health Professionals Survey (GHPS). Data from the GTSS can be used by countries to enhance their capacity to monitor tobacco use among youths and adults; to guide the development, implementation, and evaluation of national tobacco prevention and control programs; to compare tobacco-related data at the national, regional, and global levels; and to monitor articles in the WHO Framework Convention on Tobacco Control (WHO TFI) (39).

The GYTS is a school-based survey of students aged 13 to 15 years (40–42). This survey uses standardized methods for constructing the sampling frame, selecting schools and classes, preparing questionnaires, carrying out field procedures, and processing the data. The GYTS includes data on the prevalence of cigarette and other tobacco use, perceptions and attitudes about tobacco, access and availability of tobacco products, exposure to secondhand smoke, school curricula, media and advertising, and cessation. Since 1999 the GYTS has been conducted in 126 of the 192 WHO Member States. Thirty-four of the 35 WHO Member States in the Region have conducted the GYTS, and 15 countries have repeated the survey (Antigua and Barbuda, Argentina, Bahamas, Barbados, Bolivia, Chile, Costa Rica, Cuba, the Dominican Republic, Grenada, Guyana, Peru, Suriname, the USA, and Venezuela).

The GSPS is conducted in the same schools as those which participate in the GYTS, and collects data on the prevalence of tobacco use, knowledge and attitudes towards tobacco, school curricula and school policies regarding tobacco. The GSPS has been conducted in the Dominican Republic, Paraguay, Peru, and Uruguay. The GHPS is a survey of third-year university students in dentistry, medicine, nursing or pharmacy. This survey collects data on the prevalence of tobacco use, knowledge and attitudes toward tobacco, and school curricula and policies regarding tobacco. The GHPS will be pilot-tested in Argentina for third-year medical students during 2005.

In 2001, WHO, in collaboration with the Joint United Nations Program on HIV/AIDS (UNAIDS), the United Nations Educational, Scientific and Cultural Organization (UNESCO), and the United Nations Childrens' Fund (UNICEF), and with technical assistance from the CDC, initiated development of the Global School-based Student Health Survey (GSHS). The goal of the GSHS is to obtain systematic information from students on risk behaviors and protective factors related to major causes of morbidity and mortality in young people and adults. As with the GYTS, the GSHS is a school-based survey conducted primarily among students aged 13 to 15 years. The GSHS uses a standardized scientific sample selection process, common school-based methods, core questionnaire modules, core-expanded questions, and country-specific questions that are combined to form a self-administered questionnaire which can be administered during one regular class period. In November 2003 a training workshop was conducted by WHO and the CDC to train survey coordinators from eight PAHO countries in procedures to implement the survey at the country level. To date the GSHS has been completed in Guyana and Venezuela, and field work is currently under way in Chile (43).

In 2001, WHO established the Global Forum on Non-communicable Disease Prevention and Control as a network of networks to bring together six WHO regional networks for integrated NCD prevention and control. The purpose of the Global Forum is to disseminate information, exchange experiences, and support regional and national initiatives (44). Two of the oldest regional networks are the Countrywide Integrated Non-communicable Diseases Intervention Program (CINDI) established in 1982 (45), and the *Conjunto de Acciones para Reducción Multifactorial de Enfermedades No Transmisibles* (CARMEN) established in 1996 (30, 31). The primary goal of the Global Forum is to provide support to the regions and their constituent nations to develop national integrated non-communicable disease prevention and control programs based on surveillance and other activities (46). This is achieved in part through a series of annual meetings to link various regional network activities. To date, three annual meetings have been held. The First Global Forum meeting was held at the WHO Headquarters in Geneva, Switzerland in 2001 (47). The second meeting was held in Shanghai, China, in 2002 (48), and the third was held in Rio de Janeiro, Brazil, in 2003 (49). The Fourth Global Forum was held in Ottawa, Canada, in November, 2004.

Centers for Disease Control and Prevention activities

The Global Behavioral Risk Factor Surveillance conference series was initiated in 1999 by the CDC and the Finnish National Public Health Institute (KTL). Over the years this series has expanded with support and technical assistance from WHO, Health Canada, and the Australian Government Department of Health and Aging. During the first global conference, held in Atlanta, Georgia, USA in 1999, it was clear that there was a global cohort of experts in risk factor surveillance who were keen to form an informal network to share methods and findings (6). Important issues raised at the Atlanta meeting included how to identify the kinds of international networks needed to promote collaboration on chronic disease surveillance, and how results and experiences can be exchanged (11). Thus was born a tradition of having a global conference every two years. The second global conference was held in Tuusula, Finland, in 2001 (50), and the third global conference was held in Noosaville, Australia, in 2003 (51). Many participants from the Americas have played a key role in this conference series. The fourth global conference is scheduled to take place in Uruguay in 2005.

After the 1999 global conference in Atlanta, in 2000 the CDC organized two smaller but critical conferences (52). The first conference was held in Savannah, Georgia, USA, on the analysis, interpretation and use of complex social and behavioral surveillance data. It addressed technical surveillance issues including data collection, analysis, interpretation, and use. The second conference was held in Atlanta to address practical surveillance issues such as sustainability of efforts in less-developed economies, and problems related with capacity-building. Consideration of the respective roles played by the ministries of health, nongovernmental and global agencies, and universities led to a greater understanding of how each sector can support chronic disease surveillance in the Region, and helped to identify gaps in support.

One such gap was the provision of technical training and information exchange to enhance surveillance capacity. To address the need for training and information, in 2002 the CDC held an International Chronic Disease Epidemiology and Surveillance Training Course in Atlanta for Latin American participants, and provided a common vision and tools to promote chronic disease surveillance. This training course led to the creation of the Americas' Network for Chronic Disease Surveillance in 2003 (see below).

The CDC has also developed a number of national surveillance systems, and experience with these systems has informed similar initiatives in other countries in the Region. Surveillance systems developed and used in the USA include the Behavioral Risk Factor Surveillance System (BRFSS) and the Youth Risk Behavior Surveillance System (YRBSS). Established in 1984 in 15 states in the USA, BRFSS is a state-based surveillance system with monthly data collection by telephone survey (53). The questionnaire is built on a "core" module (about 80 questions) which all states use. In addition, there are CDC-supported "optional" modules that the states may choose to use unaltered. States can also use their own "state" modules, which are not supported or analyzed by the CDC, and can vary from state to state. Starting in 2002, the BRFSS provided surveillance data for local settings such as metropolitan areas and counties. In 2004, monthly data were collected for all 50 states in the USA, the District of Columbia, and Puerto Rico; annual point-in-time surveys were conducted in the Virgin Islands and Guam. More than 200 000 adult interviews are completed each year, making the BRFSS the largest telephone health survey in the world. Over the years it has accumulated a wealth of experience in survey design, data quality, and data use (54, 55). Annual conferences bring attendees up to date regarding state-of-the-art surveillance methods and technological innovations (56). All BRFSS data, methods, and questionnaires are available online (53).

The YRBSS was developed in 1990 to monitor priority health risk behaviors among young people in the USA (57). The YRBSS measures behaviors that contribute to violence and unintentional injuries, tobacco use, use of alcohol and other drugs, sexual behaviors that contribute to sexually transmitted infections, including HIV infection, and unintended pregnancy, dietary behaviors, physical inactivity and overweight. The YRBSS is conducted nationwide and among interested states and large cities. In 2003, 43 states and 22 cities participated.

The CDC released evaluation guidelines for public health surveillance systems in 1988 (58) and provided updated guidelines in 2001 (59).

Health Canada activities

Health Canada, in collaboration with Statistics Canada, continues to develop national chronic disease surveillance systems and methods (60, 61). National health surveys such as the National Population Health Survey (NPHS) (62) and the Canadian Community Health Survey (CCHS) (63) have yielded experiences that have been useful in improving survey technology. The Canadian Heart Health Initiative has provided a model for federal-provincial partnership for chronic disease surveillance (64). Conceptual models for chronic disease surveillance have been published to stimulate discussion (65, 66). The Rapid Risk Factor Surveillance System (RRFSS) was initiated in 1999 with multiple partners to produce rapid data at the local health region level (66, 67).

The Network for Health Surveillance, a national partnership of health practitioners aiming to improve surveillance capacity in Canada, was formed in 1999 (14). In 2001 the Chronic Disease Prevention Alliance of Canada (CDPAC) was constituted to strengthen links among initiatives to prevent chronic diseases in Canada (68). A situational analysis of chronic disease surveillance capacity was conducted by Health Canada in 2002. Since 2003, Health Canada has chaired a Federal/Provincial Chronic Disease Risk Factor Surveillance System Task Group, set up to develop a national strategy to strengthen Canada's ability to undertake the surveillance of chronic disease risk factors. Health Canada has also provided staff to participate in and lead regional projects and activities in chronic disease surveillance, prevention, and control.

Results of Chronic Disease Surveillance Capacity surveys

In 2000, WHO conducted a survey on the availability of programs for NCD prevention and control in various countries (69). Thirty-three countries from the Americas responded to the survey. Sixty percent of the countries in the Americas reported having NCD prevention and control programs, but only 31% reported having a dedicated budget for NCD. While 90% of the countries reported having information on mortality rates by cause of death, only 23% reported having information on the prevalence of risk factors. Furthermore, the proportion of countries in the Americas that collected NCD risk factor information varied from 39% for physical activity to 79% for anthropometric measurements. A 2001 PAHO report indicated that the use of many of the published reports for surveillance purposes was rather limited because of methodological issues (17).

In 2002 and 2003, the Planning Committee of the Americas' Network for Chronic Disease Surveillance (see below) conducted a Survey on Chronic Disease Surveillance Capacity and Activities among its members. Network members from 17 countries responded. Eleven countries (Argentina, Brazil, Chile, Colombia, Dominican Republic, Guatemala, Mexico, Panama, Peru, Uruguay and Venezuela) responded to both the 2002 and the 2003 surveys. The results indicated that on average, 73% (55% in 2002, 91% in 2003) of these countries had an organization in the Ministry of Health dedicated to chronic disease surveillance; 77% (63% in 2002, 91% in 2003) had an organization in the Ministry dedicated to the prevention and control of chronic diseases; 68% (55% in 2002, 82% in 2003) had an epidemiologist in the Ministry dedicated to chronic diseases; and 55% (36% in 2002, 73% in 2003) had financial resources designated by the Ministry for chronic disease surveillance. The priority given to chronic disease surveillance was high in 45% of the responding countries, medium in 32%, and low in 23%. The major sources of data for chronic disease surveillance included vital statistics (100%), registries (86%), hospital discharge data (69%), surveys (64%), and other sources (41%). These limited member opinion surveys show that the chronic disease surveillance capacity in these countries is still not very strong, but is improving.

2001 Non-Communicable Disease Surveillance Summit for the Americas

A milestone in capacity-building in chronic disease surveillance in the Region was the Non-Communicable Disease Surveillance Summit for the Americas, held in Atlanta, Georgia, USA in 2001 under the auspices of PAHO, WHO, and the CDC. Forty individuals from 13 countries in North, Central and South America and the Caribbean, and from international organizations such as PAHO, WHO, the World Bank, the Inter-American Development Bank and the InterAmerican Heart Foundation, attended the summit. The objective of the summit was to encourage discussion among experts from various countries to identify common critical issues in chronic disease surveillance, in order to move forward and develop a regional strategy. At the end of the 3-day summit all participants endorsed the following declaration:

> Non-communicable disease (NCD), due to its tremendous health care and productivity costs to society, its inequitable health impacts associated with poverty, and its future burden due to longer life expectancy, changes in risk behavior patterns, and significant social changes, represents a heavy and increasing burden for the health and well-being of the peoples of the Americas. Thus, a group of concerned citizens from different countries and institutions met at the "NCD Surveillance Summit" in Atlanta, Georgia in September 2001, under the auspices of the Pan American Health Organization (PAHO/WHO) and the Centers for Disease Control and Prevention (CDC), in order to explore strategies for strengthening the prevention and control of NCDs and their risk factors. Participants in the Summit decided to call on government and non-government agencies of the Americas to make a commitment towards the development and implementation of a regional non-communicable disease and risk factors surveillance initiative, as an essential component for their effective control.

2003 Americas' Network for Chronic Disease Surveillance

During the 2002 CDC International Chronic Disease Epidemiology and Surveillance Training Course for Latin America, the desire was very strong among the 20 participants from 15 countries to form a network for the purposes of sharing information and experiences, as well as providing opportunities for enhancing chronic disease surveillance in the Americas. A planning committee was set up with 12 members from Argentina, Canada, Colombia, Ecuador, Mexico, Panama, Peru, USA, Uruguay and Venezuela. Through conference calls, a secure website for all members, and meetings, the network made progress in approaching and gaining support from governments, NGOs and academic institutions in the Region and internationally. By the end of 2002 the network had 60 members from 20 countries, and by the end of 2003 it had 110 members from 24 countries. The Americas' Network for Chronic Disease Surveillance (AMNET) was formally launched in Montevideo, Uruguay, in November 2003. At its first General Assembly, attended by 70 participants, a Board of Directors was elected. The Americas' Network's first tasks are to fully develop its by-laws, to incorporate AMNET as an NGO of professional experts, to promote the dynamic exchange of information and experiences among members, and to assist the government ministries of health and other organizations in the Region in providing research and training, and in enhancing their capacities for chronic disease surveillance. In 2004 some AMNET members participated in the First Forum for Chronic Diseases of the

Americas and the Caribbean, held in Puerto Rico, to establish liaisons between countries for the development of new initiatives. Some AMNET members provided advice to training workshops and to the organizers of a risk factor survey in Colombia. Others contributed, through the exchange of information and experience, to hyperthyroidism research in Uruguay. In addition to providing regular information exchanges among members through the Internet, AMNET plans to launch a newsletter and a new website by the end of 2004, and to hold the second General Assembly and several training workshops in 2005.

Other activities

Various other activities and initiatives in chronic disease surveillance are being implemented in the Region. The Training Programs in Epidemiology and Public Health Interventions Network (TEPHINET), a nonprofit organization, were established in 1997 to strengthen international public health capacity by initiating, supporting and providing networking for field-based training programs that enhance competencies in applied epidemiology and public health practice (70). The Inter-American Development Bank provides funding to Latin American countries to finance health surveillance activities (71). In 2002 the InterAmerican Heart Foundation and the Latin American Society of Hypertension jointly initiated the Cardiovascular Risk Factor Multiple Evaluation in Latin America (CARMELA) study to assess the prevalence of risk factors of heart diseases and stroke, and the impact of socioeconomic status on risk, in seven major Latin American cities in Argentina, Chile, Colombia, Ecuador, Mexico, Peru and Venezuela. Results are expected in 2004 (72). The Foundation also published two reports (in 1996 and 2000) on heart disease and stroke in the Americas (73, 74).

New activities are appearing thanks to international collaborative and training efforts. For example, Uruguay had no chronic disease surveillance capacity in the past. In 2002 the Uruguayan ministry of public health established chronic disease surveillance as a priority, and sent participants to attend the Surveillance Training Course held at the CDC in Atlanta. Upon their return from the course, a new Epidemiology Surveillance Unit was established as a result of strong political will and newly acquired technical skills. The unit currently has a staff of five who are beginning to organize a national chronic disease surveillance system for Uruguay. In Brazil, the Mortality Information System recorded the most frequent causes of death in 2000 as circulatory system-related (32%), cancer (15%), external causes (15%), respiratory system-related (11%) and infectious (6%) (75). As a result, the surveillance of chronic diseases and their risk factors is listed as a top priority for the Unified Health System (75, 76). In Colombia, the National Institute of Health and the Ministry of Health have been developing this country's capacity for chronic disease surveillance since 2001 (77), monitoring chronic disease mortality trends (78–80), and implementing local area risk factor surveillance (81, 82). The Center for the Development and Assessment of Public Health Technology (CEDETES) created a community-based information and epidemiological surveillance system (10). In Argentina, the VIGI+A program was created in 2002 as a government and NGO network for the surveillance of chronic diseases and risk factors (83).

The Region has also been witness recently to more innovative activities. For example, it has traditionally been the mandate of governments to conduct surveillance activities. But in the United States-Mexico Border Region, a private health foundation and a local university have sponsored most surveillance activities at the local level since 1996, including 11 behavioral risk factor surveys and one prenatal risk assessment survey (84). This experience emphasizes the importance of involving the private sector and academic institutions in collaborative efforts to enhance local surveillance activities.

DISCUSSION

In consonance with the two key areas in global health identified by Flanagin and Winker (1), we see two key issues in efforts to enhance regional capacity for chronic disease surveillance in the Americas. First, how can we enhance regional activities aimed at improving local and regional surveillance systems, tools, knowledge, and expertise to monitor, control, and prevent disease and promote health in regionally relevant, affordable, and sustainable ways? Second, how can we improve and sustain local and regional research capacity and technology and knowledge transfer? From the foregoing review of activities to enhance regional capacity for chronic disease surveillance, we have identified a number of potentially useful ways to approach these key questions.

Surveillance as an art

Conducting surveillance, like playing the piano, is an art. It requires integration and adapta-

tion. All partners must be involved, just as all fingers must be used to play a good piece of music. No players, large or small, must be or even feel left out (85). In addition, experiences known to be successful in developed countries must be adapted to the reality and context of a developing country, just as a good pianist must put her feeling and variations into the music and not strictly follow the score. Although it is possible to establish an integrated system, it is impossible to establish a uniform system across the Region without local modifications. For example, the recently introduced Colombian behavioral risk factor surveillance initiative for local areas is based on an adaptation for Colombia of the BRFSS developed for the USA (53) and the WHO STEPwise approach (26), using the PAHO risk factor questionnaires for chronic diseases (81, 82).

Surveillance as a science

Surveillance is also a science. There are certain basic scientific principles that must be upheld through all aspects, components and stages of data collection, analysis, interpretation, and information dissemination (65, 86, 87). This view parallels the standard piano techniques and music theories that one must learn to become a good pianist. In this regard, transfer of surveillance technology and expertise, as through PAHO, WHO, and CDC workshops, meetings and training courses, becomes instrumental.

Network of networks

In the Americas we need to network to enhance the capacity for chronic disease surveillance at both the national and regional levels. Each nation in the Region requires a network, but on a Region-wide level we need a network of networks (a metanetwork). A network of networks can be institutional (e.g., PAHO, CARMEN and the Global Forum), professional (e.g., the newly established Americas' Network for Chronic Disease Surveillance), or a mix of the two. Metanetworking can provide added value for the Region by helping countries unable to develop capacity from successful examples in other countries. It can also help build surveillance capacity by facilitating improved technical cooperation, information sharing, education and training, development of a common surveillance tool built upon country consensus, and development of a common marketing strategy. Metanetworking can also serve in a coordinating capacity to help define the roles and responsibilities of the multiple, and sometimes overlapping, networks in the Region. Because of the rapidly changing global chronic disease burden due to a combination of factors including the spread of risk factors across country borders, a regional solution is needed. Countries simply cannot afford to work alone any longer.

Surveillance of surveillance

Surveillance is the responsibility of countries. Metanetworks cannot and should not conduct surveillance for the countries; the mandate of a metanetwork should be surveillance of surveillance. In other words, such a network should "police the policies." It could monitor and evaluate how well countries are conducting surveillance and developing policies for surveillance, identify gaps and overlaps (which emerge from the nature of overlapping networks), and suggest solutions. Such a regional system to evaluate the performance of country-specific surveillance systems constitutes a surveillance system of surveillance systems (24). When individual countries realize that metanetworks can help them in surveillance, regional capacities will be strengthened.

"SCIENCE"

Finally, we propose seven important themes for enhancing regional chronic disease surveillance capacity in the Americas. These can be concisely summarized in the acronym "SCIENCE," which stands for *s*trategy, *c*ollaboration, *i*nformation, *e*ducation, *n*ovelty, *c*ommunication, and *e*valuation. *Strategy* refers to the need to develop a strategy to promote and market chronic disease surveillance. *Collaboration* involves multiple stakeholders from all walks of society in devising a common approach to surveillance. *Information* will improve accuracy, timeliness, and regional comparability of surveillance information. *Education* is needed to inform scientists, policy makers and the public about the current epidemiological shift from infectious to chronic diseases, and the importance and preventability of chronic diseases. *Novelty* will make it possible to develop new, innovative, nontraditional ways of thinking. *Communication* can be used to develop effective ways to convey chronic disease messages and surveillance results and findings to various key audiences, such as policy makers and the general public, who often do not have time to read scientific reports and publications. *Evaluation* refers to the need to assess the design, implementation, and utility of our surveillance efforts, with emphasis on ensuring that surveillance results are used for public health action.

This paper has limitations. First, the literature review was not exhaustive nor was it based on keyword search strategies. It was based on a review of personal collections of reports and documents from various sources. However, the authors are closely involved in chronic disease surveillance activities in the Americas. In fact, many of our personal notes and documents on important and current activities may not appear in any formally published literature. Second, this overview may give the impression that the activities of some agencies or organizations are more visible than others. Nevertheless, it is hoped that the experiences summarized in this paper will help enhance the capacity for chronic disease surveillance in the Americas.

Acknowledgments. The authors thank Anita Pak (University of Ottawa, Canada) and Laura Kann (CDC) for their helpful comments and suggestions.

SINOPSIS

Medidas para reforzar la vigilancia de las enfermedades crónicas en las Américas

Existe la necesidad de reforzar la capacidad regional para la vigilancia de las enfermedades crónicas en las Américas. Los objetivos de este artículo son 1) ofrecer nuestro apoyo decidido a favor de la vigilancia de las enfermedades crónicas, 2) presentar una revisión descriptiva y un resumen de las actividades de vigilancia y los problemas en torno a las mismas en las Américas, 3) confeccionar una lista de recursos y fuentes de consulta para obtener más información, y 4) ofrecer unas recomendaciones para reforzar la capacidad regional. Este artículo se basa en una revisión personal de informes, sitios de Internet y apuntes personales procedentes de diversos proyectos, reuniones y actividades relacionados con la vigilancia de las enfermedades crónicas en las Américas, y en un análisis a profundidad de los materiales recopilados. Se ha determinado que las agencias sanitarias internacionales, los gobiernos de diversos países, las organizaciones no gubernamentales y los profesionales de la sanidad pública han dedicado grandes esfuerzos a la construcción y al desarrollo de las capacidades de vigilancia de las enfermedades crónicas en la Región. Para seguir apoyando el aumento de dichas capacidades, se hace necesario establecer una red de redes (una metarred) cuya misión debería ser la vigilancia de la vigilancia. Siete aspectos importantes para el aumento de esta capacidad son la estrategia, la colaboración, la información, la educación, la novedad, la comunicación, y la evaluación.

Palabras clave: enfermedad crónica, vigilancia, epidemología, Américas.

REFERENCES

1. Flanagin A, Winker MA. Global health—targeting problems and achieving solutions. A call for papers. JAMA 2003;290: 1382–4.
2. Bonita R, Winkelmann R, Douglas KA, de Courten M. Chapter 3. The WHO Stepwise approach to surveillance (STEPS) of non-communicable disease risk factors. In: McQueen DV, Puska P, eds. Global Behavioral Risk Factor Surveillance. New York: Kluwer Academic/ Plenum Publishers; 2003. Pp. 9–22.
3. World Health Organization. World Health Report 2002. Reducing Risks, Promoting Healthy Life. Geneva: World Health Organization; 2002. (Also available from: http://www.who.int/whr/ 2002/en/. Accessed 1 September 2004.)
4. World Health Organization. World Health Statistics 2000. Geneva: World Health Organization; 2002.
5. Pan American Health Organization. Health in the Americas. Scientific Publication No. 569. Washington, D.C.: Pan American Health Organization; 1998; 1:1.
6. McQueen DV, Puska P, eds. Global Behavioral Risk Factor Surveillance. New York: Kluwer Academic/Plenum Publishers; 2003.
7. Choi BCK, Bonita R, McQueen DV. The need for global risk factor surveillance. J Epidemiol Community Health. 2001; 55: 370.
8. Ecuador (Instituto Nacional de Estadística y Censos (INEC)). Sistema Integrado de Consultas a los Censos Nacionales. Available from: http://www.inec.gov.ec. Accessed 2 September 2004.
9. Corber SJ, Robles SC, Ordunez P, Rodriguez P. Chapter 17. Non-communicable Disease Surveillance in Latin America and the Caribbean. In: McQueen DV, Puska P, eds. Global Behavioral Risk Factor Surveillance. New York: Kluwer Academic/Plenum Publishers; 2003. Pp. 227–32.
10. de Salazar L. Chapter 14. Epidemiological Surveillance System in Latin America and the Caribbean. In: McQueen DV, Puska P, eds. Global Behavioral Risk Factor Surveillance. New York: Kluwer Academic/Plenum Publishers; 2003. Pp. 197–207.
11. Puska P. Chapter 2. Why is global surveillance necessary? In: McQueen DV, Puska P, eds. Global Behavioral risk factor surveillance. New York: Kluwer Academic/Plenum Publishers; 2003. Pp. 3–7.
12. Chile. La brecha de la equidad, América Latina, el Caribe y la Cumbre Social, 1997. Santiago, Chile: Economic Commission for Latin American and the Caribbean (ECLAC); 1997.
13. Chile. Panorama social de América Latina, 1996–1997. Santiago, Chile: Economic Commission for Latin American and the Caribbean (ECLAC); 1997.
14. Canada. F/P/T Working Groups. Partnering for quality, timely surveillance leading to action for better health: proposal to develop a network for health surveillance in Canada. Ottawa: Health Canada; 1999.
15. McKenna MT, Taylor WR, Marks JS, Koplan JP. Chapter 1. Current issues and challenges in chronic disease control. In:

Brownson RC, Remington PL, Davis JR, eds. Chronic Disease Epidemiology and Control. 2nd ed. Washington, D.C.: American Public Health Association; 1998. Pp. 1–26.
16. Pan American Health Organization. Health in the Americas. Volume I, Volume II. Washington, D.C.: Pan American Health Organization; 2002.
17. Orduñez P, Silva LC, Rodríguez MP, Robles S. Prevalance estimates for hypertension in Latin America and the Caribbean: are they useful for surveillance? Pan Am J Public Health 2001; 10: 226–39.
18. Barceló A, Rajpathak S. Incidence and prevalence of diabetes mellitus in the Americas. Pan Am J Public Health 2001; 10:300–8.
19. Silva LC, Ordúñez P, Paz Rodríguez M, Robles S. A tool for assessing the usefulness of prevalence studies done for surveillance purposes : the example of hypertension. Pan Am J Public Health 2001;10:152–60.
20. Pan American Health Organization. NCD Surveillance Toolkit: Risk Factors for Non-communicable Diseases. English version available from: http://www.paho.org/english/hcp/hcn/ncd-surv-tools.htm. Spanish version available from: http://www.paho.org/spanish/hcp/hcn/ncd-surv-tools. htm. Accessed 3 September 2004. (The questionnaires referred to in the paper are only available on the website. For hard copies contact Pan American Health Organization, Area of Disease Prevention and Control, Unit on Non-Communicable Diseases, Washington, D.C., USA).
21. Virtual Health Library for Noncommunicable Diseases (VHL-NCD). English version available from: http://ncd.bvsalud.org. Spanish version available from: http://ncd.bvsalud.org/html/es/home.html. Accessed 3 September 2004.
22. Pan American Health Organization. The Central America Diabetes Initiative (CAMDI): Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua. English version available from: http://www.paho.org/English/HCP/HCN/IPM/camdi.htm, http://www.paho.org/English/AD/DPC/NC/camdi.htm. Spanish version available from: http://www.paho.org/Spanish/HCP/HCN/IPM/camdi-1.htm. Accessed 3 September 2004.
23. Bonita R, de Courten M, Dwyer T, Jamrozik K, Winkelmann R. Surveillance of risk factors for noncommunicable diseases: The WHO STEPwise approach. Summary. Geneva: World Health Organization, 2001. (Also available from: http://www.who.int/ncd_surveillance/steps/en/. Accessed 1 September 2004.)
24. Choi BCK, Eijkemans GJM, Tennassee LM. Prioritization of occupational sentinel health events for workplace health and hazard surveillance: the Pan American Health Organization experience. J Occup Environ Med 2001; 43 : 147–57.
25. Choi BCK, Tennassee LM, Eijkemans GJM. Developing regional workplace health and hazard surveillance in the Americas. Pan Am J Public Health 2001; 10:376–81.
26. Bonita R, de Courten M, Dwyer T, Jamrozik K, Winkelmann R. Surveillance of risk factors for noncommunicable diseases: The WHO STEPwise approach. Summary. Geneva: World Health Organization; 2001.
27. Armstrong T, Bonita R. Capacity building for an integrated noncommunicable disease risk factor surveillance system in developing countries. Ethnicity Dis 2003;13:S2–13.
28. World Health Organization. World Health Report 2003. Shaping the Future. Chapter 6: Neglected global epidemics—three growing threats. Geneva: World Health Organization; 2003. (Also available from: http://www.who.int/whr/2003/chapter6/en/. Accessed 1 September 2004.)
29. World Health Organization. Noncommunicable Disease Surveillance. Available from: http://www.who.int/ncd_surveillance/en/. Accessed 1 September 2004.
30. World Health Organization. Conjunto de Acciones para Reducción Multifactorial de Enfermedades No Transmisibles (CARMEN). Available from: http://www.who.int/hpr/globalforum/regional.networks.shtml#CARMEN. Accessed 1 September 2004.
31. The CARMEN Network. CARMEN: An Initiative for Integrated Prevention of Noncommunicable Diseases in the Americas. Washington, D.C.: Pan American Health Organization, 2003. (English version available from: http://www.paho.org/english/ad/dpc/nc/carmen-info.htm. Spanish version available from: http://www.paho.org/spanish/ad/dpc/nc/carmen-info.htm.)
32. Lippe J and Strong K. WHO Global NCD InfoBase User Manual Version 1.0. Geneva: World Health Organization; 2003.
33. World Health Organization. Global NCD InfoBase. Available from: http://www.who.int/ncd_surveillance/infobase/en. Accessed 3 September 2004.
34. Strong K, Bonita R. Investing in Surveillance: a fundamental tool of public health. Soz Präventivmed 2004;49:269–75.
35. World Health Organization. Mega Country Health Promotion Network. Available from: http://www.who.int/hpr/mega/index.shtml. Accessed 2 September 2004.
36. Douglas KA, Yang G, McQueen DV, Puska P. Chapter 13. Mega Country Health Promotion Network Surveillance Initiative. In: McQueen DV, Puska P, eds. Global Behavioral Risk Factor Surveillance. New York: Kluwer Academic/Plenum Publishers; 2003. Pp. 179–96.
37. World Health Organization. Tobacco Free Initiative (TFI). Surveillance and monitoring. Available from: http://www.who.int/tobacco/surveillance/en/. Accessed 24 September 2004.
38. Centers for Disease Control and Prevention. Global Tobacco Prevention and Control. Overview. Available from: http://www.cdc.gov/tobacco/global/overview.htm. Accessed 24 September 2004.
39. World Health Organization. Tobacco Free Initiative (TFI). WHO Framework Convention on Tobacco Control (WHO FCTC). Available from: http://www.who.int/tobacco/framework/en/. Accessed 24 September 2004.
40. World Health Organization. Global Youth Tobacco Survey (GYTS). Available from: http://www.afro.who.int/tfi/projects/gyts.html. Accessed 1 September 2004.
41. GYTS Collaborative Group. Tobacco use among youth: a cross country comparison. Tobacco Control. 2002;11:252–70.
42. GYTS Collaborative Group. Differences in worldwide tobacco use by gender: Findings from the Global Youth Tobacco Survey. J School Health 2003;73:207–15.
43. World Health Organization. Global School-based Student Health Survey (GSHS) Fact Sheet. Geneva: World Health Organization, 2001. (Also available from: http://www.who.int/school_youth_health/assessment/gshs/en/. Accessed 1 September 2004.)
44. World Health Organization. Regional Networks for Integrated NCD Prevention and Control. Available from: http://www.who.int/hpr/globalforum/regional.networks.shtml. Accessed 2 September 2004.
45. World Health Organization. Countrywide Integrated Non-communicable Diseases Intervention (CINDI) Programme. Available from: http://www.who.dk/CINDI. Accessed 2 September 2004.
46. World Health Organization. The Global Forum on Integrated NCD Prevention and Control. Available from: http://www.who.int/hpr/globalforum/index3.shtml. Accessed 2 September 2004.
47. World Health Organization. Proceedings of the Global Forum on Noncommunicable Disease Prevention and Control, 2001. Geneva: World Health Organization; 2001. (WHO/NPH/02.5).
48. World Health Organization. Report of the Second Meeting of the Global Forum on Noncommunicable Disease Prevention and Control, 2002. Geneva: World Health Organization; 2002. (WHO/NMH/NPH/NCP/03.4).
49. World Health Organization. Report of the Third Meeting of the Global Forum on Noncommunicable Disease Prevention and Control, 2003. Geneva: World Health Organization; 2003.
50. Second Global Conference: Monitoring Health Behaviors—Towards Global Surveillance, Finland, Tuusula, October 1–3, 2001. Available from: http://www.ktl.fi/monitoring2/program.htm. Accessed 1 December 2003.

51. Third Global Conference: Global Issues in Surveillance of Health Behaviours in Populations—Translating Data into Action, Noosaville, Australia, October 15–17, 2003. Available from: http://www.asmsurveillance03.com/. Accessed 1 September 2004.
52. McQueen DV, Elsner LG. Chapter 12. Analysis, Interpretation, and Use of Complex Social and Behavioral Surveillance Data. In: McQueen DV, Puska P, eds. Global Behavioral Risk Factor Surveillance. New York: Kluwer Academic/ Plenum Publishers; 2003. Pp. 155–77.
53. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System. Available at http://www.cdc.gov/brfss/index.htm. Accessed 24 September 2004.
54. Holtzman D. Chapter 5. Analysis and interpretation of data from the U.S. Behavioral Risk Factor Surveillance System (BRFSS). In: McQueen DV, Puska P, eds. Global Behavioral Risk Factor Surveillance. New York: Kluwer Academic/ Plenum Publishers; 2003: 35–46.
55. Mokdad AH, Bales VS, Greenlund KJ, Mensah GA. Public health surveillance for disease prevention: lessons from the Behavioral Risk Factor Surveillance Sytem. Ethnicity Dis. 2003; 13: S2-19–23.
56. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System, Conference 2004. Available from: http://www.cdc.gov/brfss/conference/. Accessed 1 September 2004.
57. Centers for Disease Control and Prevention. Youth Risk Behavior Surveillance System. Available from: http://www.cdc.gov/nccdphp/dash/yrbs/. Accessed 1 September 2004.
58. Klaucke DN, Buehler JW, Thacker SB, Parrish RG, Trowbridge FL, Berkelman RL and the Surveillance Coordination Group. Guidelines for evaluating surveillance systems. MMWR; 1988: 37 (S-5):1–18. (Also available from: http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/00001769.htm. Accessed 1 September 2004.)
59. Guidelines Working Group. Updated Guidelines for Evaluating Public Health Surveillance Systems. MMWR; 2001: 50 (RR13): 1–35. (Also available from: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5013a1.htm. Accessed 1 September 2004.)
60. Health Canada. Chronic Disease Surveillance in Canada: A Background Paper. Ottawa: Centre for Surveillance Coordination, Health Surveillance Coordination Division, 2003. Available from: http://www.hc-sc.gc.ca/pphb-dgspsp/csc-ccs/pdf/hscchronic_disease_surveillance_background_paper_e.pdf. Accessed 19 November, 2004.
61. Health Canada. Injury Surveillance in Canada: Current Realities and Challenges. Ottawa: Centre for Surveillance Coordination, & Centre for Healthy Human Development, 2003. Available from: http://www.injuryprevention strategy.ca/downloads/Injury SurveillanceinCanada.pdf. Accessed 19 November 2004.
62. Canada. National Population Health Survey (NPHS). Ottawa: Statistics Canada, 1994. (Also available from: http:// www.statcan.ca/english/Dli/Data/Ftp/nphs.htm. Accessed 1 September 2004.)
63. Canada. Canadian Community Health Survey (CCHS). Ottawa: Statistics Canada, 2000. (Also available from: http://stcwww.statcan.ca/english/sdds/3226.htm. Accessed 1 September 2004.)
64. MacLean DR, Joffres MR, Tan MH, Petrasovits A. Prevalence of cardiovascular risk factors in Canadians with diabetes mellitus. In: Angel A, ed. Diabetes and Cardiovascular Disease: Etiology, Treatment and Outcomes. New York: Kluwer Academic/Plenum Publishers; 2001. Pp. 373–9.
65. Choi BCK. Perspectives on epidemiologic surveillance in the 21st century. Chronic Dis Can 1998; 19: 145–51.
66. Choi BCK, Mowat D. Vision of a rapid, flexible, cost-effective, survey-based public health surveillance system. J Epidemiol Community Health 2001; 55: 612.
67. Stewart PJ, Sales P. Evaluation of the Rapid Risk Factor Surveillance System: Final Report. Ottawa: Community Health Consulting, 2000. Available from: http://www.cehip.org/rrfss/resources/Evaluation%20of%20the%20RRFSS,%20May%202000.pdf. Accessed 19 November 2004.
68. Chronic Disease Prevention Alliance of Canada (CDPAC). Newsbytes 2003; 5: 1–2. Available from: http://www.cdpac.ca/content/newsroom/newsbytes.asp. Accessed 19 November 2004.
69. Alwan AD, Maclean D, Mandil A. Assessment of National Capacity for Noncommunicable Disease Prevention and Control. Geneva: World Health Organization; 2001.
70. TEPHINET. From Evidence to Action: Global Strategies for Public Health in the New Millennium. Atlanta: The Training Programs in Epidemiology and Public Health Interventions Network, 2000. Available from: http://tephinet.org/documents/prog2000.pdf. Accessed 19 November 2004.
71. Blyde JS, Fernandez-Arias E. Economic Growth in the Southern Cone. Washington, DC: Inter-American Development Bank (IADB). Available from: http://www.iadb.org/regions/re1/econ/RE1-04-004.pdf. Accessed 19 November 2004.
72. IAHF. CARMELA Study. Dallas, Texas: InterAmerican Heart Foundation, 2004. Available from: http://www.iahf.org/What.html. Accessed 19 November 2004.
73. Wielgosz AT. Cardiovascular and Cerebrovascular Diseases in the Americas, 1996. Dallas: InterAmerican Heart Foundation; 1996.
74. Wielgosz AT, Champagne BM, Finizola B, Granero R, Hassell T, Labarthe DR, et al. Heart Disease and Stroke in the Americas, 2000. Dallas: InterAmerican Heart Foundation; 2000.
75. Brazil, Ministry of Health. Noncommunicable Disease Prevention and Control in Brazil. Brasilia: Ministry of Health; 2002.
76. Brazil, Ministério da Saúde. Vigilância Epidemiológica. Available from: http://www.funasa.gov.br/epi/ntransmi/epi_ntransmi_00.htm. Accessed 15 December 2003.
77. Gonzalez M, Alvarez V, Duran R, Espinosa G, Henriquez D, Piñeros M, et al. La vigilancia en salud pública de las enfermedades crónicas no transmisibles. Santa Fe de Bogotá, Colombia: Ministerio de Salud—Instituto Nacional de Salud; 2001.
78. Gonzalez M, De la Hoz F. Mortalidad por enfermedades crónicas en Colombia durante el período de 1990 a 1999. Inf Quinc Epidemiol Nac. 2002;7:209–31.
79. Gonzalez M, De la Hoz F. Mortalidad por enfermedades cardiovasculares en Colombia durante el período de 1990 a 1999. Inf Quinc Epidemiol Nac. 2002;7: 417–39.
80. Gonzalez M. Principales causas de mortalidad por cáncer en Colombia. Inf Quinc Epidemiol Nac. 2003;8:41–52.
81. Gonzalez M, García I, Prieto F, Saboya M, Velandia M, Arcón M, et al. Factores de riesgo de enfermedades crónicas no transmisibles, Valledupar, Colombia, diciembre de 2003. Inf Quinc Epidemiol Nac. 2004;9:54–60, 65–76, 81–8.
82. Gonzalez M. Factores de riesgo de enfermedades crónicas no transmisibles, San Juan de Pasto, Colombia, junio de 2004. Inf Quinc Epidemiol Nac. 2004;9 (in press).
83. Argentina, Ministerio de Salud. Vigilancia de enfermedades no transmisibles—VIGI+A. Available from: http://www.direpi.vigia.org.ar/no_transm/index.htm. Accessed 1 September 2004.
84. Center for Border Health Research, University of Texas. El Paso health report. El Paso, Texas: Paso del Norte Health Foundation; 2004. Available from: http://www.pdnhf.org/detail.asp?dt=topics&id=68&arch=yes&fr=c. Accessed 23 November 2004.
85. Choi BCK, Pak AWP. Lessons for surveillance in the 21st century: a historical perspective from the past 5 millennia. Soz Präventivmed. 2001;46:361–8.
86. Choi BCK, Pak AWP, Ottoson JM. Understanding the basic concepts of public health surveillance. J Epidemiol Community Health. 2002;56:402.
87. Choi BCK, Ackland M. Understanding the functional components of public health surveillance. J Epidemiol Community Health. 2003;57:783.