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Enhancing global capacity in the surveillance, prevention, and control of chronic diseases: seven themes to consider and build upon

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ABSTRACT

Background: Chronic diseases are now a major health problem in developing countries as well as in the developed world. Although chronic diseases cannot be communicated from person to person, their risk factors (for example, smoking, inactivity, dietary habits) are readily transferred around the world. With increasing human progress and technological advance, the pandemic of chronic diseases will become an even bigger threat to global health.

Methods: Based on our experiences and publications as well as review of the literature, we contribute ideas and working examples that might help enhance global capacity in the surveillance of chronic diseases and their prevention and control. Innovative ideas and solutions were actively sought.

Results: Ideas and working examples to help enhance global capacity were grouped under seven themes, concisely summarised by the acronym "SCIENCE": *S*trategy, *C*ollaboration, *I*nformation, *E*ducation, *N*ovelty, *C*ommunication and *E*valuation.

Conclusion: Building a basis for action using the seven themes articulated, especially by incorporating innovative ideas, we presented here, can help enhance global capacity in chronic disease surveillance, prevention and control. Informed initiatives can help achieve the new World Health Organization global goal of reducing chronic disease death rates by 2% annually, generate new ideas for effective interventions and ultimately bring global chronic diseases under greater control.

In today's world, global health is everyone's concern.[1] Chronic diseases (which in this paper will exclude infectious diseases) are the leading cause of adult mortality in all regions of the world.[2 3] Even so, they have yet to secure a place on the international health agenda.[3–5] Thus, we now have an urgent need to enhance the world's capacity in monitoring, preventing and controlling chronic diseases.

Every country, regardless of economic development, must now deal with the problem of chronic diseases.[2–4 6–10] Although such diseases are not communicable, their risk factors are readily transferable.[11] For example, unhealthy lifestyles are communicated through migration, the media, modern communication and the globalisation of markets.[12]

Increasing urbanisation and industrialisation further contribute to the problem, with more processed food, greater stress, more pollution and less physical activity.[13 14] Prevalence of obesity is on the rise in many countries.[15–18] Put simply, human progress and technological advance have brought about a global epidemic of "diseases of comfort".[19] Many developing countries lack the expertise and resources to conduct surveillance, prevention and control activities,[2 4 9] and are increasingly turning to the World Health Organization for advice.[20]

This paper extends the ideas set forth in a previous paper on chronic disease surveillance in the Americas.[21] In that paper, seven important themes were recommended for enhancing capacity in the surveillance of chronic disease, themes that can be remembered through the acronym "SCIENCE": *S*trategy, *C*ollaboration, *I*nformation, *E*ducation, *N*ovelty, *C*ommunication and *E*valuation. This paper discusses these themes within a context that adds prevention and control. Ideally, this paper will enhance efforts to build global capacity in the fight against chronic diseases.

METHODS

The ideas and working examples described in this paper have four sources: firstly, the authors' own experiences and participation in relevant activities; secondly, the authors' publications; thirdly, a review of some relevant literature; and, fourthly, discussion and consultation among the authors and other experts from 2003 through mid-2007. The authors are affiliated with organisations in North America, Europe, Australia and South America.

Ideas and examples to enhance global capacity in dealing with chronic diseases were collected from the authors. These were then synthesised and categorised into seven themes. The original manuscript underwent a number of major revisions, based on critical reviews by the authors, which finally led to this consensus document.

In this paper, 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".[22] Surveillance (also called monitoring[23]) is "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

Table 1 Terms and phrases similar to those used to describe the seven themes summarised in the acronym "SCIENCE"

Theme	Similar terms and phrases
*S*trategy	Action plan, big picture thinking/planning, coherent response, integrative approaches, leadership, long-term funding, making the case, marketing skills, resource mobilisation, selling stories to our masters
*C*ollaboration	Engaging providers and users, multidisciplinary expertise, networking, partnership, promoting dialogue between countries, 2 plus 2 equals 5
*I*nformation	Accessible information, accurate data, comparability, data standard, local needs, quality information products, relevant data, right-to-know versus right-not-to-know, timely data
*E*ducation	Creating user pull not provider push, enhancing local capacity, raising awareness, training young researchers and practitioners
*N*ovelty	Innovation, new ideas, new thinking, thinking outside the box
*C*ommunication	Clear message, connecting the dots, consistent message, knowledge translation, mechanism to consult silent groups, media relations, packaged information, simple language, timely dissemination
*E*valuation	Achieving goals and objectives, built-in evaluation system, evidence-based policy, monitoring data utilisation, participatory action research, putting knowledge into action

who need to know".[24] Prevention is defined as promoting, preserving and restoring health when it is impaired, and minimising suffering and distress.[25] Control is defined as ongoing operations or programmes aimed at reducing incidence or prevalence of adverse conditions, or eliminating such conditions.[25]

RESULTS

Terms and phrases similar to the seven themes represented by the SCIENCE acronym are listed in table 1.

Strategy

Develop a strategy to promote and market chronic disease surveillance, prevention and control.

Marketing is essential to obtaining continued funding for projects and programmes in chronic diseases, and to better delivering information and interventions to the target populations.[26] In all cases, marketing must be based on solid facts and arguments, such as demonstration of likely cost effectiveness, as well as interest, relevance and application.[27] Accordingly, public health practitioners should become better versed in marketing, or professionals with expertise in marketing should be hired.

Many political leaders and others who can influence funding do not seem to have any sense of urgency about chronic disease.[28] Their perceptions must be changed, perhaps by economic arguments. Saving the lives of 35 million people over the next 10 years, the global goal set by WHO in 2005, is eminently achievable and enormous.[28] Besides, the terms "chronic disease" and "non-communicable disease" could be replaced with a new, more compelling term.[11] "Chronic" conveys to decision-makers the idea of a disease being always present and, therefore, non-urgent; "non-communicable" conveys the idea of non-infectiousness and implies that these diseases are safe. Moreover, chronic disease may seem an unappealing target to health ministers with short-term appointments. In Venezuela, there has been a new minister of health every 11 months for the past 7 years—how can such an official target chronic diseases, which may take 20–30 years to develop? The reality is that to effectively tackle chronic diseases at the population level, one must deal with their risk factors,[6] and thus appeals to potential funders might emphasise problems such as smoking, poor diet, excessive drinking and inactivity and how they contribute to major causes of death. If risk factors can be modified, favourable trends (for example, in smoking rates) might be seen quickly, even within 11 months.

A global strategy helps countries develop appropriate national policies.[3 6] Examples include the WHO Framework Convention on Tobacco Control (FCTC)[29] and the WHO Global Strategy on Diet, Physical Activity and Health.[30] National strategies must also be fashioned. The Public Health Agency of Canada (PHAC) provides an example of how a country can develop strategic documents on mission, vision, mandate, business lines, public health goals, public health strategies and corporate priorities.[31] Within an agency or ministry, strategies are needed to foster a productive work environment, such as staff retention, teamwork culture and linkages between national and regional offices.

One must also recognise that the strategies in developed and developing countries could be different, because of different health systems, governmental structures and socioeconomic issues for these two groups of countries.

Collaboration

Involve multiple stakeholders from all walks of society in devising a comprehensive approach to surveillance, prevention and control.

Collaboration is nice in principle but often difficult to achieve. To envision collaboration, the concept of "harmonisation" is preferred to "standardisation"—a "salad bowl" rather than a "melting pot" approach. Different jurisdictions should not be required to do things in the same way, but duplication of efforts should be minimised. Sometimes, pettiness and territorialism are partly to blame for duplication of efforts and inefficiency. To avoid obstructionism, all stakeholders need to be part of the conversation from the beginning.

Governing bodies are required that will be sympathetic to all the participating jurisdictions, able to facilitate the sharing of ideas and capable of furthering public health agendas. This could avoid potential pitfalls and challenges. For example, the desire and efforts to develop a worldwide comparable questionnaire for physical activities suitable for use in all countries eventually led to two major versions, the International Physical Activity Questionnaire (IPAQ)[32] and the Global Physical Activity Questionnaire (GPAQ).[33] Harmonisation requires a careful balancing act between global and local needs across all participating jurisdictions, hard to achieve but always desirable.

International efforts, by definition, require collaboration. The Central American Survey on Chronic Diseases and Related Risk Factors, coordinated by PAHO (Pan American Health Organization), in collaboration with the US CDC (Centers for Disease Control and Prevention), is being carried out in seven countries.[34] With a sample size of 15 000, this survey requires collaboration of governments, academics, scientific societies, patient associations, non-governmental organisations (NGOs) and others across the entire Central American subregion.

One good example of engaging various stakeholders is seen in the School-Based Surveillance System in Colombia, where community, staff, leaders, planners, and funders all help to make the system work.[35] Another is the Canadian Rapid Risk Factor Surveillance System (RRFSS), a model for involving local partners in funding a surveillance system that can produce useful data for dealing with local needs.[36 37]

Surveillance, prevention and control have traditionally been the responsibility of government, but stakeholders such as

NGOs and academic institutions also need to be involved.[38] In the US-Mexico Border Region, a non-profit organisation and a local university have sponsored 11 behavioural risk factor surveys.[39] In Venezuela, a local NGO, ASCARDIO, translated and tested the Global Youth Tobacco Survey; it also organised a coalition to implement, analyse and disseminate the survey.[40]

Sometimes a third party is needed to achieve international collaboration. Over the past 10 years, Israeli, Jordanian and Palestinian health professionals have worked together through the Canada International Scientific Exchange Program to screen 17 000 Arab and Israeli newborn babies for hearing loss and to carry out other activities.[41] In this case, building on WHO's "Health as a Bridge for Peace" concept,[42 43] Canada served as a third-party "honest broker"[44] to initiate collaboration that otherwise would not have happened. Similarly, an international collaborative paper on "diseases of comfort" by the heads of the public health associations of the United Kingdom, United States and Australia was brokered by a Canadian scientist specialising in knowledge translation.[19] Finally, for evidence-based decision-making to be successful, collaboration between scientists and policy-makers must be improved, preferably by knowledge brokers.[45]

Information

Improve accuracy, timeliness, accessibility and global comparability of surveillance information to develop policies and programmes.

To maintain good information, an organising framework is needed. Examples include the Australian National Health Performance Framework[46] and the Canadian Health Information Framework.[47]

Further improvement of data accuracy is urgently needed. A study in Venezuela, for example, found that about one-third of the death certificates listing myocardial infarction as a cause of death were in error according to WHO MONICA case definitions.[48] Because questionnaires are so important in collecting health information, a catalogue of biases in questionnaires is now available.[49]

Data must be collected on an ongoing, continuous basis, or at least with "sufficient continuity" to track relevant changes and trends.[50–52] The European Collaboration in Health Behaviour Surveillance, started in Finland in 1978 and then the Baltic countries in the 1990s, first as Finbalt Health Monitor and more recently as the broader Cindi Health Monitor, collects health behaviour data on a regular basis.[53 54] These systems provide information valuable for healthy public policies. The US Behavioral Risk Factor Surveillance System (BRFSS),[55] the National Health and Nutrition Examination Survey (NHANES)[56] and the Canadian Community Health Survey (CCHS)[57] collect data on a continuous basis. Because of its continuous data, the BRFSS was used at the time of disasters, such as the Oklahoma bombing (1995), the 11 September attacks (2001), and Hurricane Katrina (2005). After 11 September 2001 attacks, questions were added to the BRFSS to measure some of its possible effects, such as changes in the prevalence of smoking and use of alcohol.[58]

For chronic diseases, information must be collected over a long period of time in a consistent way, and linkable to historical records. For example, a newly identified case of mesothelioma might be caused by exposures that occurred 30 years earlier. The French experience in surveillance indicates an information system must be built on three basic principles: sustainability, quality assurance and interoperability (ability to operate across platforms, operating systems and programming languages).[59]

Global information needs to be collected according to agreed-upon priorities. The WHO STEPwise approach to surveillance (STEPS) is a global programme designed to standardise surveillance methodology in low and middle income countries.[60 61] The WHO Global InfoBase, a tool for policy, programme and research,[62] brings together available data on risk factors to facilitate cross-country comparisons. The US BRFSS model has been adapted by various countries, including Russia[63 64] and China.[65]

It is also important to move beyond a "core" dataset to address the needs of local jurisdictions. In addition, current surveillance systems should start looking at the sociological and ecological perspectives of health.[66] For example, since 2002 the US CDC has merged BRFSS data with US Environmental Protection Agency (EPA) county-level data on environmental pollutants.

Surveillance information must be efficiently linked to policy development. For example, when the United States had a shortage of influenza vaccine in 2004, 17 questions on vaccination were added to the BRFSS. This provided CDC with timely estimates of vaccine coverage, which were used to change vaccination policies based on supply and demand.[67 68] Influenza can worsen chronic conditions such as heart disease and diabetes.[69]

To link data to action, surveillance can be conceptualised as a "learning system" that must involve data providers, researchers and data users; connects to other macro-systems of public health; has an ability to learn from both the macro-systems and the knowledge produced by the surveillance system itself; and performs networking, social marketing and information-brokering functions.[70]

Traditionally, information has been disseminated by the "encyclopaedia approach", where reports, atlases, etc, are used to disseminate findings regularly.[71] But today, it may be better to use "fire alarms", giving information to decision-makers only when the indicators exceed a predetermined level. To apply this approach, standard indicators are needed for continuous surveillance.[72 73] Indicators must maximise inter-regional comparability[74] and produce good summary measures for easy use by decision-makers.[75]

Education

Inform scientists, policy-makers and the public about the current epidemiological shift from infectious to chronic diseases, and the importance of preventing these problems.

Education should raise awareness and build capacity. In Uruguay, public health practitioners talk about "TTT" (try, try again and training): effort (try), perseverance (try again) and education (training) help build the resources and expertise needed to tackle chronic diseases.

Training and education of frontline public health practitioners is essential. In China, the National Population and Family Planning Commission in collaboration with Tsinghua University and the University of Toronto is planning to broaden the skills of 150 000 of its primary care workers. Moving these workers from a focus on reproductive health to a societal perspective may improve population health. In southern Africa, the "school without walls" approach applies peer-to-peer education, study visits and mentoring programmes to enhance community capacity.[76]

Partnering professionals and institutions in low-income and middle-income countries with those in high-income countries

will no doubt bear fruit. The Canadian Institutes of Health Research (CIHR) has been fostering such partnerships and has recently announced grants to further stimulate these partnerships.[77]

At present the field of public health needs to attract more medical, dental, nursing students as well as graduate students. The Global Forum for Health Research and the *Lancet* recently sponsored their first joint essay competition for young professionals on ideas on combating disease and promoting health.[78] Additional exposure to public health, perhaps through practicums in agencies such as WHO, PAHO, CDC, PHAC or the National Public Health Institute (KTL), may help. Alternatively, it may be useful to establish "teaching health units" within these agencies for both education and research. Such organisations might even start their own teaching programmes.

In addition, universities could establish programmes and courses in global health. In Canada, the University of Toronto has a centre for international health[79]; Simon Fraser University is planning to start a degree programme in global health in 2007.

In medical schools, teaching programmes should present structured messages about the urgency of controlling chronic diseases, and they could switch from the traditional acute care model to a comprehensive chronic care model.

It is important to understand how people interpret health messages and why some take action while others do not. For example, many people retain a healthy weight, while others become obese. Understanding the underlying dynamics could yield clues for effective education and intervention.[80] However, presenting information does not mean education, and education does not mean action. It is important to find ways to motivate the learners and to reward them when they put what they learn into action.[81]

Novelty

Develop novel ways of thinking about both traditional and emerging problems.

New thinking is needed to meet the latest challenges in data collection, such as the increasing popularity of cellular telephones, or the rising interest of governments in shielding their citizens' health information.[82] As the traditional telephone survey may be passé,[83] and meaningful epidemiological studies based on record linkages may become impossible, new avenues will have to be explored.

Traditionally, physical activity has been difficult to measure through questionnaires. In the future, instruments currently limited to small samples and specialised studies may be used in population health surveys. For example, pedometers may be used to measure daily steps[84]; personal photometers to measure light exposure (a risk factor for skin cancer).[85] Personal air sampling[86 87] and biological monitoring,[86 88] widely used in occupational health, may eventually be used in population health surveys.

New ideas are needed to bridge the gap between scientists and policy-makers, much of which will involve simplification.[89] In brief, high-powered research must be stepped down to "household voltage".[90] One example is reducing complex concepts and study results to visually interesting presentations.[91] Another example is using the counting of people at a meeting to illustrate complex theories of statistical bias, stratification and mathematical modelling.[92]

New synthetic indices for health, similar to the Dow Jones Industrial Average (for stocks) need to be developed to summarise and facilitate the use of surveillance data.[93 94] It may be possible to develop 365 public health indicators (one a day) to be reported on television to the general public, with each indicator illustrating a public health issue.[95] New user-friendly tools for disseminating information should be invented, perhaps like the office fountain used by the Xerox Corporation to chart its stock. Water flow, controlled through an ethernet connection to a computer, strengthens when the price does.[96]

Mnemonics can help as well. For example, chapter 4 of the World Health Report 2002 has been summarised using mnemonics.[97] To promote one's health, the first defence is to "play SAFE": try to refrain from *S*moking, drink *A*lcohol in moderation, maintain balanced *F*ood intake and *E*xercise regularly. If this fails, "call a COP": get examined and check for high blood *C*holesterol, *O*besity and high blood *P*ressure. If this also fails, "expect HARM": look for signs and symptoms of *H*eart disease, cancer (*A*bnormal cell growth), *R*espiratory disease and *M*ental disorder, and go for early treatment.

Another approach would be using songs or stories: suggestions at a PAHO workshop for Latin America included writing folk songs for radio on the health effects of pesticides and organising concerts to promote healthy practices.[98] Telling stories has long been used by First Nations people for education, and that could be effective in minority groups who do not speak the mainstream language.[99] The use of modern health proverbs is another approach; it may now be time to educate people through new proverbs based on research and surveillance.[100] Furthermore, new models of rapid, flexible, and cost-effective surveillance need to be envisioned; one formulation involves a franchise model, turnkey package and global positioning system.[37] Moving from linear to systems thinking is a direction for new thinking efforts.

Communication

Develop effective ways to convey chronic disease messages and the results and findings from surveillance to key audiences, such as policy-makers and the general public, who generally do not read scientific publications.

Communication is needed to put science into policy and policy into action. Everyone should speak a common language, or have a good translator or interpreter.[101] Minimising the gap between scientists and policy-makers may require new incentives, a new breed of scientists (knowledge brokers or translational scientists) or creating a chief knowledge officer.[45 91]

Celebrities, whether international stars or publicly known figures, can be effective advocates for health promotion. In Uruguay, a popular radio announcer was named the head of an NGO against overconsumption of alcohol, helping to convey health messages to the public through ratio broadcasts. A star of a popular show on Spanish-language television partnered with PAHO to launch a regional campaign "Move America" ("A Moverse América") to promote physical activity and healthy nutrition.[102] In Italy, mineral water is used as a symbol of health in advertisements, with national football team players drinking water as a sign of success.

To raise awareness, statistics can be prepared on how many famous people have recently died of chronic diseases. Another project could be counting the cases of blindness and limb amputations caused by diabetes mellitus. Or instead of telling sports enthusiasts the years of life lost as a result of smoking, tell them the number of football or soccer championships they are going to miss in their lifetime.[90] "Smoking makes you ugly" is an innovative approach to promote smoking cessation.[103] Teenage smokers may not care about the long term but can

Policy implications

- Although chronic diseases are not communicable from person to person, their risk factors are readily transferable through international migration, modern technology and globalisation.
- It is important to enhance global capacity in the surveillance, prevention and control of chronic diseases.
- This paper discusses with examples seven themes that can help enhance global capacity.

What this paper adds

- The seven themes to enhance global capacity in the surveillance, prevention and control of chronic diseases are summarised in the acronym "SCIENCE": S for Strategy, C for Collaboration, I for Information, E for Education, N for Novelty, C for Communication, E for Evaluation.
- Examples are provided from both developing and developed countries to illustrate the seven themes.

certainly relate to immediate problems of smoking-induced facial wrinkles,[104–106] baldness[107] and psoriasis.[108]

Commenting on the 43 000 traffic deaths in a year in the United States, the National Highway Traffic Safety Administration told the *New York Times* that "losing the equivalent of a fully loaded airliner every other day is clearly not acceptable".[109] Farther north, Canada's chronic disease clock on the Public Health Agency of Canada website ticks away to show the number of deaths from chronic diseases both "year to date" and for each day as it unfolds (in Canada, about one such death occurs every 3 minutes).[110 111] The Mexican Diabetes Federation reminds people, "five Mexicans die from diabetes every hour".[112]

Public health practitioners can also learn from weather forecasters about how to communicate with the general public, such as using universal non-word symbols to denote public health events and presenting short-range and long-range public health forecasts.[113]

In communication, one must differentiate between the general public and decision-makers. The general public should receive health messages that raise awareness, persuade people to change their unhealthy lifestyles, teach practical skills and provide support for maintaining a healthy life. Decision-makers should receive messages to help them develop healthy public policies and practices. In Finland, the national behavioural monitoring system has been collecting information on the general population's support for changes in tobacco policy, such as provision of smoke-free worksites, and has communicated such findings through various media.[53]

Evaluation

Assess the design, implementation, utility and effectiveness of initiatives in chronic disease, with emphasis on ensuring that these efforts produce public health benefits.

Evaluation is a form of surveillance. The process of evaluation measures how well knowledge is being put into effective action. Strengthening the capacity of surveillance systems refers not only to the scientific process of collecting, analysing, interpreting and publishing data, but also to using such data for policy. Evaluating a surveillance system is "surveillance of surveillance".[21] Monitoring how well we are putting policy into action is another form of evaluation, "policy surveillance" (policing the policies).[21] Surveillance has been shown to be a valuable tool for evaluating the effectiveness of health promotion policies such as laws on drinking and driving.[114]

The city government of Bogotá, Columbia, implemented strategies to promote physical activity through urban redesign. Instead of building more double-decker highways to accommodate the increasing number of cars in the city, it built a bicycle route ("Cicloruta", a 300 km network of bicycle paths), a new mass transit system ("Transmilenio") and a bicycle way ("Ciclovia", which closes 120 km of streets for people to enjoy walking, jogging, dancing and cycling on Sundays and holidays). It was found that, after implementation of these environmental changes, car users dropped from 17% to 12%, and people who walk increased from 7% to 12%.[115]

Evaluation must take place at multiple levels and include stakeholders throughout the process. It is advisable that evaluation becomes a built-in component of any public health initiatives. Finally, there is a role for civil society in evaluating and setting research priorities.[45] Some research funding agencies, such as CIHR, have developed processes to engage stakeholders and the public in evaluating health research. CIHR peer review committees now involve community reviewers, citizens interested in the evaluation of research proposals.[116]

DISCUSSION

This paper summarises under seven themes a variety of ideas and working examples that should inform our thinking about how to enhance global capacity for tackling chronic diseases in the years to come. The goal announced by WHO is to reduce death rates from chronic disease by 2% annually,[2] and thus innovative thinking on how to address the escalating pandemic of chronic diseases, especially in countries with limited resources, should be welcomed.[6] It is the responsibility of the readers to test these ideas and working examples in their own time frame, situation and locale, adapt them as needed and use them to stimulate more ideas. The acronym "SCIENCE" (*S*trategy, *C*ollaboration, *I*nformation, *E*ducation, *N*ovelty, *C*ommunication, *E*valuation) makes a relatively easy mnemonic, and those who incorporate its components in an initiative to monitor, prevent or control chronic disease should serve the population well.

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