

## Chronic Diseases: Chronic Diseases and Development 5



# Monitoring and surveillance of chronic non-communicable diseases: progress and capacity in high-burden countries

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The burden of chronic, non-communicable diseases in low-income and middle-income countries is increasing. We outline a framework for monitoring of such diseases and review the mortality burden and the capacity of countries to respond to them. We show data from WHO data sources and published work for prevalence of tobacco use, overweight, and cause-specific mortality in 23 low-income and middle-income countries with a high burden of non-communicable disease. Data for national capacity for chronic disease prevention and control were generated from a global assessment that was done in WHO member states in 2009–10. Although reliable data for cause-specific mortality are scarce, non-communicable diseases were estimated to be responsible for 23·4 million (or 64% of the total) deaths in the 23 countries that we analysed, with 61% occurring in people who were younger than 70 years. Tobacco use and overweight are common in most of the countries and populations we examined, but coverage of cost-effective interventions to reduce these risk factors is low. Capacity for prevention and control of non-communicable diseases, including monitoring and surveillance operations nationally, is inadequate. A surveillance framework, including a minimum set of indicators covering exposures and outcomes, is essential for policy development and assessment and for monitoring of trends in disease. Technical, human, and fiscal resource constraints are major impediments to the establishment of effective prevention and control programmes. Despite increasing awareness and commitment to address chronic disease, concrete actions by global partners to plan and implement cost-effective interventions are inadequate.

### Introduction

Globally, around 57 million people died in 2008, and 33 million (58%) of these deaths were due to chronic (non-communicable) diseases (mainly cardiovascular disease, diabetes, cancer, and chronic respiratory diseases).<sup>1</sup> The burden of such diseases in low-income and middle-income countries is rapidly increasing and already has major adverse social, economic, and health effects.<sup>2,3</sup> Progress towards prevention has not kept pace with the rising burden of chronic diseases—a failing that is chiefly one of the politics of priority setting and not of the absence of effective interventions.<sup>4</sup> A previous *Lancet* Series<sup>5</sup> estimated that potentially 32 million deaths from chronic diseases could be averted in 10 years in 23 low-income and middle-income countries that have a high burden of such diseases if global partners were to support widespread adoption of three cost-effective interventions (on tobacco and salt intake and hypertension). Mortality in these 23 countries (which are listed in figure 1) accounted for around 23·4 million (80%) of deaths from non-communicable diseases in all low-income and middle-income countries in 2005, and 50% of the total burden of disease.<sup>1</sup> The previous Series<sup>5</sup> called for support for prevention of chronic diseases from global partners such as WHO, and actions were outlined for rapid implementation of cost-effective interventions.

In 2000, the World Health Assembly endorsed a global strategy<sup>7</sup> for the prevention and control of non-communicable diseases. The plan had three key components: surveillance to track and monitor the major risk factors; promotion of health to reduce these risk

factors; and improved management to promote access to health care. The World Health Assembly subsequently endorsed the WHO framework convention on tobacco control (FCTC),<sup>8</sup> and the global strategy on diet and physical activity and health,<sup>9</sup> along with proposed scaling-up of technical support to countries taking part in

### Key messages

- Low-income and middle-income countries are undergoing a rapid rise in the burden of non-communicable diseases with major adverse social, economic, and health outcomes
- We provide a surveillance framework to quantify and monitor non-communicable diseases and their determinants
- Prevalence of tobacco use in men and overweight in men and women are high in many of the 23 low-income and middle-income countries with high rates of non-communicable disease
- Age-specific death rates for non-communicable diseases are higher in the 23 low-income and middle-income countries than it is in high-income countries
- Health-system capacity in the 23 countries with a high burden of non-communicable diseases, including surveillance, is inadequate to reduce the disease burden and urgently requires strengthening
- Disease surveillance should be integrated into national health information systems and regular monitoring of actions to prevent non-communicable diseases is needed

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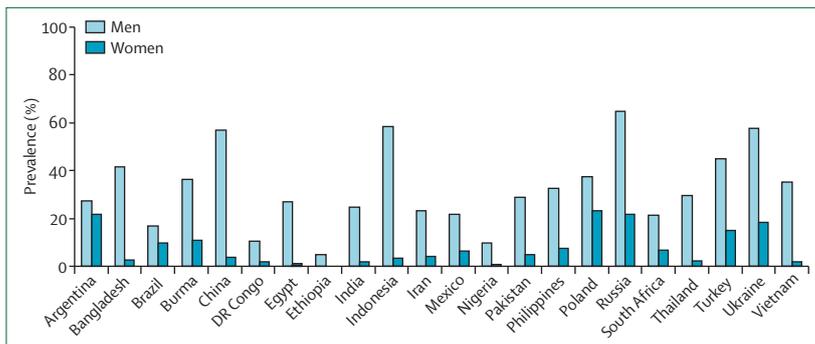
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**Figure 1: Estimated prevalence of daily tobacco use in adults aged 15 years or older, 2005**  
Data from WHO's report on the global tobacco epidemic.<sup>8</sup> No data for tobacco use were available for Colombia.

surveillance of risk factors. In 2008, WHO developed an action plan<sup>10</sup> in collaboration with its member states to convert the strategies into actions.

Surveillance and monitoring are crucial to provide countries with the information needed about development of policies and programmes for non-communicable diseases, and to support the assessment of these initiatives and monitor progress. The capacity to undertake surveillance for these purposes varies greatly around the world and was judged inadequate in many low-income and middle-income countries.<sup>11</sup> We present a framework for surveillance and monitoring of non-communicable disease in 23 high-burden countries, covering major risk factors, cause-specific mortality, and the capacity of countries for prevention.

## Methods

As part of the implementation of its non-communicable diseases action plan,<sup>10</sup> WHO established an expert epidemiology reference group in 2009 to help to develop a national disease-surveillance framework. Components and the core indicators were adopted on the basis of existing WHO techniques and data sources that are used for periodic reporting (every few years) of health issues, such as WHO updated mortality estimates, global tobacco surveillance system,<sup>12</sup> the STEPwise approach to chronic disease risk factor surveillance,<sup>13</sup> Global NCD InfoBase,<sup>14</sup> and other relevant databases.

WHO periodically estimates deaths globally, regionally, and nationally by cause.<sup>15</sup> We draw on provisional estimates for the year 2008, which are presently under country consultation. These estimates use standard methods<sup>16</sup> that draw on updated estimates of all-cause mortality,<sup>17</sup> the latest available death-registration data,<sup>18</sup> WHO and UNAIDS programme estimates for some specific causes (tuberculosis, HIV-1/AIDS, and malaria), updated estimates of cause-specific deaths in children younger than 5 years,<sup>19</sup> and estimates of cancer deaths by site for 2008 from the IARC Globocan database.<sup>20</sup>

For 12 of the 23 countries we assessed, we calculated mortality rates from recent death-registration data, which were projected to the year 2008 if 2008 data were not

available. Additional country-specific data sources or studies were used to update estimates for India,<sup>21,22</sup> China,<sup>23</sup> Thailand,<sup>24</sup> and Vietnam.<sup>25</sup> For the seven other countries (four in Asia and three in Africa), deaths by age, sex, and cause were estimated for 2008 with cause-of-death models as described elsewhere,<sup>15</sup> together with cause-specific estimates as noted previously.

WHO published mortality projections from 2004 to 2030 that were calculated with equivalent methods to those applied in the original global burden of disease study.<sup>26</sup> A set of simple models were used to project future health trends, chiefly on the basis of projections of economic and social development, and with the historically observed relations of these projections with cause-specific mortality rates. The projections we suggest here for the 23 countries have been revised to take into account the updated base estimates for 2008, updated projections of real change in income per head (which take into account the effects of the global financial crisis),<sup>27–29</sup> and updated projections for tobacco-related deaths (which take into account present trends in tobacco consumption).

We used a common core of indicators (ie, tobacco, body-mass index, and mortality) for comparability of information across countries and regions. Lack of comparability of data is one of the major difficulties faced by global surveillance and monitoring. It is also crucial that the core indicators can be technically measured in all resources settings.

Comparable estimates for tobacco use and overweight (body-mass index  $\geq 25$ ) for 2005 as key risk factors for non-communicable diseases are shown. The data used to calculate these estimates were aggregated data provided to WHO by countries and obtained through a review of published and unpublished work. These data were captured in the WHO Global InfoBase,<sup>14</sup> which is a continuously updated repository of all country-reported data for eight key risk factors for chronic diseases and is maintained by WHO.<sup>14</sup> The inclusion criteria for our estimation analysis included data that had come from a random sample of the general population, with clearly described survey methods (including sample sizes) and risk factor definitions. We made adjustments to enhance comparability between the standard definitions of risk factors, standard set of age groups for reporting, standard reporting year, and representativeness of population. We used regression modelling to produce crude and age-specific rates of a hypothetical standard indicator for all 23 countries. Full descriptions of the methods used to produce these estimates have been published elsewhere.<sup>30,31</sup>

To review progress in tobacco control, we did an analysis of the effectiveness of the implementation of selected demand-reduction measures of WHO FCTC. Summarised by WHO in the acronym MPOWER, these measures refer to monitoring of tobacco use and prevention policies; protection of people from tobacco

smoke; offers of help to quit; warnings about the dangers of tobacco; enforcement of bans on advertising, promotion, and sponsorship; and raising of taxes on tobacco products. A detailed description of this assessment has been published elsewhere.<sup>6</sup>

Data for health-system capacity were drawn from a global questionnaire assessment of country capacity for prevention and control of non-communicable diseases, which was done between November, 2009, and April, 2010 (hereafter referred to as the 2010 country capacity assessment). Our assessment was designed to measure individual country capacity to respond to prevention and control of chronic diseases. Specific areas of assessment were the public health infrastructure for non-communicable diseases; the status of relevant policies, strategies, action plans, and programmes; health-information systems, surveillance, and surveys; health-system capacity for early detection, treatment, and care of non-communicable diseases; and health promotion, partnerships, and collaboration. Country questionnaire surveys asked participants about the existence of a unit, branch, or department in their Ministry of Health with responsibility for non-communicable diseases, and whether the policy was integrated and operational, had available funding for surveillance, monitoring, and assessment, and whether guidelines, protocols, or standards existed (see webappendix pp 8–40). 22 of 23 high-burden countries responded to the questionnaire, with only Colombia not responding in 2010.

Our assessment included a set of detailed instructions to complete the questionnaire and a glossary of terms we used (webappendix pp 38–40). The questionnaire was translated into Spanish, French, and Russian to encourage completion by all countries. The final set of questions and instructions were provided through use of an electronic Microsoft Excel questionnaire method, which was completed by professionals nationally and led by the focal point for non-communicable diseases within the Ministry of Health of every country and approved by Ministry of Health senior officials before submission to our group at WHO.

The major components of our proposed national surveillance framework for non-communicable diseases encompassed key risk factors (consisting of behavioural, dietary, physiological, and metabolic factors), outcomes (mortality and morbidity), health-system response interventions, and health-system capacity. For every component of the proposed surveillance framework, a core and expanded set of indicators was proposed for global and national monitoring (see webappendix pp 1–7). Core indicators had to have an established evidence-base and policy relevance, and be modifiable through cost-effective interventions, feasible and affordable to obtain, achievable within a country's technical capacity, and measurable in a consistent manner with valid definitions and techniques. We show several core indicators for the 23 high-burden countries.

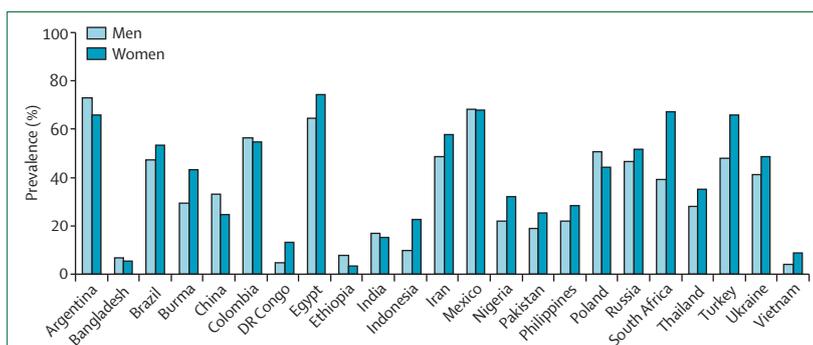


Figure 2: Estimated prevalence of overweight (body-mass index of 25 or more) in adults aged 15 years or older, 2005

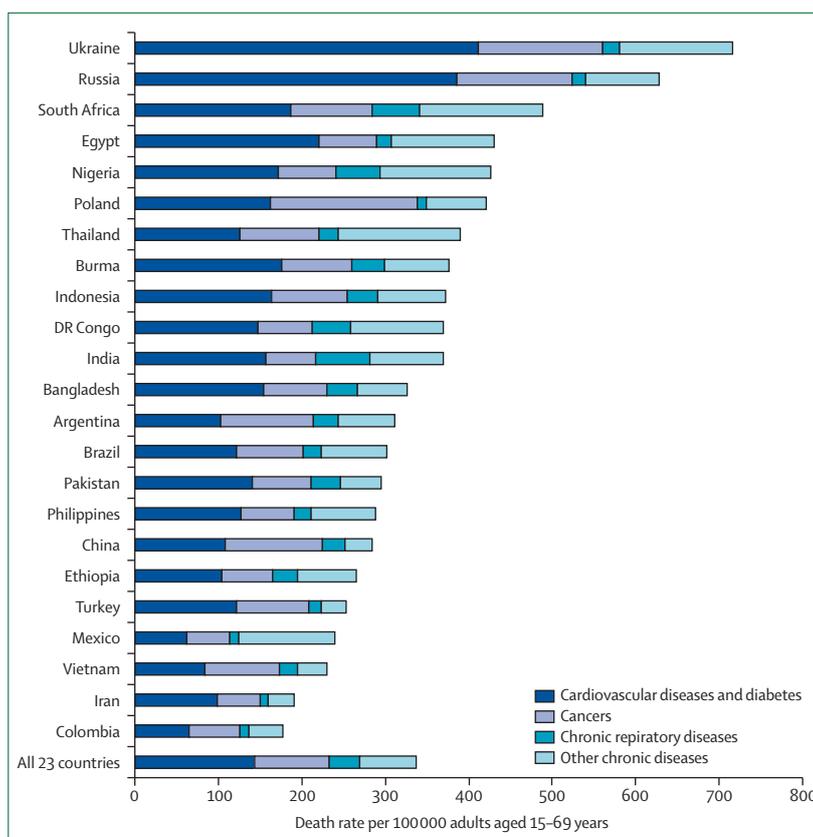


Figure 3: Death rates from non-communicable diseases per 100 000 adults aged 15–69 years in 23 high-burden countries

### Risk factors

We estimated that the prevalence of tobacco use in 2005 was high in men in most of the 23 countries that we analysed compared with prevalence for low-burden countries, and that the highest rates were reported in eastern Europe and Asia (figure 1); prevalence was highest in China (57.1%), Indonesia (58.4%), and Russia (64.9%). Prevalence of tobacco use in men was lower, at around 10% or less, in some African countries (Ethiopia, Nigeria, and Democratic Republic of the Congo) compared with other high-burden countries, although South Africa was

See Online for webappendix

an exception, with a prevalence of 21·3%. In general, fewer women use tobacco than do men; for example, in China the prevalence for women was 3·7%.

Figure 2 shows the 2005 estimates for adult prevalence of overweight in the 23 countries with a high burden of non-communicable diseases. Prevalence of overweight in men ranged from 4% in Vietnam to 73% in Argentina, and in women from 3% in Ethiopia to 74% in Egypt. In 15 of 23 countries, prevalence of overweight in women was higher than it was in men, and in three countries it was more than twice as frequent (DR Congo, Indonesia, and Vietnam). In ten of 23 countries, more than 50% of the population was overweight in 2005.

### Mortality

Deaths from chronic disease in the 23 high-burden countries accounted for 23·4 million (41%) of global deaths from all causes and 80% of deaths from non-communicable diseases in all low-income and middle-income countries. Deaths from non-communicable diseases in people aged younger than 70 years in the 23 countries accounted for 61% of all non-communicable disease deaths in these countries and for 71% of such deaths in people younger than 70 years globally.

Age-specific death rates were higher in many low-income and middle-income countries than they were in high-income countries. For the 14 countries with death registration data for cause of death, the overall age-standardised death rates from non-communicable diseases were 711 per 100 000 for men (58% higher than that for men in high-income countries in 2008) and 508 per 100 000 for women (69% higher).

Of the 23 countries shown in figure 3, death rates from chronic diseases in people aged 15–69 years were highest in eastern European countries such as Ukraine and Russia, and in some countries of the African continent such as South Africa, Egypt, and Nigeria. Although age-specific death rates for most non-communicable diseases are projected to decline with increasing rates of economic development, the ageing of the populations of these countries will lead to a substantially increased overall number of deaths. Overall mortality from non-communicable diseases for people younger than 70 years is projected to rise from 10·8 million in 2010 to 15·4 million in 2050 for the 23 countries we examined. Whereas deaths from infectious disease in people younger than 70 years are projected to decline by around 2% per year during the next 40 years, the number of deaths from cardiovascular disease are projected to increase by 0·7% per year, and from cancer by 1·1% per year in high-burden countries.

### Country capacity

Of the 23 high-burden countries we selected to investigate, only one country (Colombia) did not participate in the 2010 assessment. In the 2010 survey, all countries, apart from Poland, reported the existence of a unit, branch, or department in their Ministry of Health with responsibility for non-communicable disease. However, of these countries, only 17 reported having an integrated policy, strategy, or action plan in place, which were reported as being operational in only 13 countries (table 1). In this context, operational means that the country believes that the policy is being actively implemented. With respect to policies, strategies, or plans of action to address individual diseases or risk factors, 18 countries reported plans to address cancer (country data not shown), 19 countries reported having a tobacco control policy, and only 18 countries reported policies or programmes for diet or physical activity (table 1).

For national surveillance systems for non-communicable diseases, most countries had funding for surveillance, monitoring, and assessment (table 2). 20 countries reported that mortality data were contained in their national health reporting system, but only ten of these countries stated that their mortality data were population-based (table 2) and only seven reported regular provision of reliable data for cause-specific mortality to WHO. With respect to risk factors for non-communicable diseases, 17 countries reported that their national health-reporting system detailed risk factors, and 11 of these systems included

	Integrated NCD policy		Policy addressing specific risk factors			
	Developed	Operational	Alcohol	Unhealthy diet	Physical inactivity	Tobacco
Argentina	Yes	No	No	Yes	Yes	Yes
Bangladesh	Yes	Yes	Yes	Yes	Yes	Yes
Brazil	Yes	Yes	Yes	Yes	Yes	Yes
Burma	Yes	No	Yes	Yes	Yes	Yes
China	No	NA	No	No	No	No
DR Congo	Yes	No	Yes	Yes	Yes	Yes
Egypt	Yes	Yes	NR	Yes*	NR	Yes*
Ethiopia	Yes	No	Yes	Yes	Yes	Yes
India	Yes	Yes	Yes	Yes	Yes	Yes
Indonesia	Yes	Yes	Yes	Yes	Yes	Yes
Iran	No	NA	No*	Yes*	Yes*	Yes*
Mexico	Yes	Yes	Yes	Yes	Yes	Yes
Nigeria	Yes	Yes	Yes	Yes	Yes	Yes
Pakistan	No	NA	No*	No*	No*	No*
Philippines	Yes	Yes	Yes	Yes	Yes	Yes
Poland	Yes	Yes	Yes	Yes	Yes	Yes
Russia	Yes	Yes	Yes	Yes	Yes	Yes
South Africa	Yes	Yes	Yes	Yes	Yes	Yes
Thailand	Yes	Yes	Yes	Yes	Yes	Yes
Turkey	No	NA	Yes*	Yes*	Yes*	Yes*
Ukraine	No	NA	No*	No*	No*	Yes*
Vietnam	Yes	Yes	No	No	No	No
Overall	17/22 (77%)	13/22 (59%)	15/22 (68%)	18/22 (82%)	17/22 (77%)	19/22 (86%)

Data were reported to WHO as part of the NCD country capacity assessment in 2010. Colombia did not respond to the capacity assessment, so no data were available. NCD=non-communicable disease. NA=not applicable. NR=not reported. \*Country did not report risk factor as part of their integrated NCD policy, but did report a standalone policy.

**Table 1: Presence of an integrated non-communicable disease policy, operational status, and inclusion of specific risk factors for 22 countries with high burdens of non-communicable diseases**

	Mortality	Cancer registry	Risk factors
Argentina	Yes*	Yes	Yes*
Bangladesh	No	Yes	Yes
Brazil	Yes*	Yes*	Yes*
Burma	Yes	Yes	Yes
China	Yes*	Yes	Yes*
DR Congo	Yes	No	No
Egypt	Yes*	Yes	Yes*
Ethiopia	Yes	No	No
India	Yes	Yes	Yes
Indonesia	Yes	Yes	Yes
Iran	Yes*	Yes*	Yes*
Mexico	Yes*	Yes	Yes*
Nigeria	Yes	Yes	Yes*
Pakistan	No	No	No
Philippines	Yes	Yes*	Yes*
Poland	Yes*	Yes*	Yes*
Russia	Yes*	Yes	No
South Africa	Yes*	Yes	Yes*
Thailand	Yes	Yes	Yes
Turkey	Yes	Yes*	Yes*
Ukraine	Yes*	Yes	Yes
Vietnam	Yes	Yes	No
Overall	20/22 (91%)	19/22 (86%)	17/22 (77%)

Data were reported to WHO as part of the NCD country capacity assessment in 2010. Colombia did not respond to the capacity assessment, so no data were available. NCD=non-communicable disease. \*Population-based data.

**Table 2: Presence of surveillance data in national health-reporting systems in 22 countries with high burdens of non-communicable diseases**

population-based data; for disease registers, only five countries reported having a population-based cancer registry (table 2).

Respondents were asked whether their countries had guidelines, protocols, or standards available for the management of risk factors and conditions leading to non-communicable disease, particularly for primary care. We contend that guidelines are generally available, but implementation is low. Much the same was noted about availability of essential medicines for treatment and management of chronic diseases, countries reported high availability but low affordability (country data not shown).

### 2000 versus 2010 country capacity assessments

The 2010 country capacity survey was done on the basis of a similar survey by WHO in 2000.<sup>11</sup> Of 22 high-burden countries that participated in the 2010 assessment, 20 also contributed to the 2000 assessment (with the exceptions of Ukraine and South Africa), allowing comparison of responses to common questions between the two assessments. A question about implementation was added to the 2010 assessment because the first survey was limited by an absence of differentiation between the presence of a policy or programme and its implementation.

	Dedicated NCD office in Ministry of Health		Cardiovascular disease policy			Cancer policy		
	2000	2010	2000	2010	Operational in 2010	2000	2010	Operational in 2010
Argentina	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Bangladesh	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Brazil	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Burma	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
China	Yes	Yes	Yes	No	No	Yes	Yes	Yes
DR Congo	Yes	Yes	No	No	NA	No	No	NA
Egypt	No	Yes	No	NR	NA	No	Yes	Yes
Ethiopia	Yes	Yes	No	Yes*	No	No	Yes*	No
India	Yes	Yes	NR	Yes*	Yes	Yes	Yes*	Yes
Indonesia	No	Yes	No	Yes	Yes	No	Yes	Yes
Iran	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mexico	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nigeria	Yes	Yes	No	Yes*	Yes	No	Yes	No
Pakistan	No	Yes	No	No	NA	Yes	No	NA
Philippines	Yes	Yes	Yes	Yes*	Yes*	Yes	No	NA
Poland	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Russia	Yes	Yes	Yes	Yes*	Yes	No	Yes*	Yes
Thailand	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Turkey	Yes	Yes	No	Yes	No	No	Yes	No
Vietnam	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Overall	14/20 (70%)	19/20 (95%)	11/20 (55%)	16/20 (80%)	13/20 (65%)	13/20 (65%)	17/20 (85%)	14/20 (70%)

Data were reported to WHO as part of NCD country capacity assessments in 2000 and 2010. Colombia, South Africa, and Ukraine did not respond to the capacity assessment in either 2000 or 2010, so no data were available. NA=not applicable. NCD=non-communicable disease. NR=Country did not respond to this question. \*Integrated NCD policy (an integrated policy addresses more than one risk factor or more than one NCD, in this case cardiovascular disease or cancer).

**Table 3: Countries reporting key elements of non-communicable disease prevention capacity, 2000 and 2010**

The existence of a unit, branch, or department with responsibility for non-communicable diseases within a country's Ministry of Health had increased from 70% in 2000 to 95% in 2010 (table 3). Similarly, more countries report the existence of a policy, strategy, or action plan for a range of chronic disease problems—ie, for cardiovascular disease the proportion increased from 55% to 80% and for cancer from 65% to 80%. Respondents suggested that there was an increase in the availability of guidelines for management of diabetes and hypertension during the decade, with an increase from 35% to 80% for diabetes and 40% to 80% for hypertension.

However, despite the presence of a unit for non-communicable diseases within a Ministry of Health, only a few countries have implemented their guidelines for management of such diseases. Equally, although a high rate of surveillance for risk factors was reported in 2010, our assessment does not provide accurate information about the quality and regularity of data collection, nor does it clarify whether standardised methods—for example, the WHO STEPwise<sup>13</sup> approach to surveillance of risk factors—were used.

WHO framework convention on tobacco control			Number of countries (%)
Article	Criteria		
Monitoring of tobacco use	20	Recent (data for 2003 or later), representative (survey sample representative of the national population), and periodic (occurring at least every 5 years) data for adults (15 years or older) and adolescents (13–15 years)	4 (17%)
Protection from tobacco smoke	8	All public places wholly smoke-free (or at least 90% of the population covered by complete subnational smoke-free legislation)	3 (13%)
Offers of help to quit	14	National quit telephone line, with nicotine-replacement therapy and some cessation services cost-covered; smoking cessation support available in health clinics or other primary-care facilities, hospitals, offices of health professionals, or the community	2 (9%)
Warnings about dangers	11, 12	≥50% (average of the front and back of the cigarette pack), including pictures or pictograms and appropriate characteristics such as specific health warnings mandated, appearing on individual packages and on any outside packaging and labelling used in retail sale, describing specific harmful effects of tobacco use on health; warnings are large, clear, visible, legible, rotate, and are written in all principal language(s) of the country	4 (17%)
Enforced bans	13	Ban on all forms of direct and indirect advertising	5 (22%)
Raised taxes	6	>75% of retail price is tax	1 (4%)

**Table 4: Number of countries with a high burden of chronic, non-communicable diseases that had implemented demand-reduction measures in December, 2008**

### Country capacity for implementation of tobacco control

WHO's report of the global tobacco epidemic<sup>6</sup> noted that 20 of the 23 countries with a high burden of non-communicable diseases had joined the FCTC by 2009. The large number of high-burden countries now in this organisation is much the same as that reported globally, in which 170 countries—or about 90% of the world population—are parties to the convention.

Our analysis also assessed the implementation of various measures of the MPOWER plan of action, which is designed to reduce demand for tobacco (table 4). The most widely implemented strategies were enforcement of bans on all forms of direct and indirect advertising (Egypt, Iran, Burma [Myanmar], South Africa, and Thailand), monitoring of tobacco use (Argentina, India, Iran, and Poland), and warnings about the dangers (Brazil, Egypt, Iran, and Thailand). Only three countries have made public places entirely smoke-free (Colombia, Iran, and Turkey). Only two countries (Brazil and Iran) have implemented adequate measures to help smokers to quit, and only one country (Poland) has increased taxes on tobacco.

### Discussion

Our analysis shows that, in high-burden countries, the capacity to effectively deal with the existing and projected burden of non-communicable diseases is inadequate. Chronic diseases are a leading health and developmental challenge.<sup>32</sup> The situation is especially serious in low-income and middle-income countries that are undergoing a rapid rise in premature mortality and an increasing burden on their health systems despite availability of cost-effective interventions.<sup>33</sup> Such diseases are

compromising sustainable development efforts and poverty reduction initiatives.<sup>32,34</sup>

A key component of any national strategy to address this challenge is to quantify and monitor non-communicable diseases and their determinants through sustainable surveillance schemes that are integrated into the national information system. Our analysis provides a step towards the development and implementation of national surveillance systems by offering a framework for surveillance and monitoring of countries against which results of key core indicators can be assessed in the future.

We appreciate the limitations of the data presently available to monitor non-communicable diseases. Concerted efforts are in progress to improve the coverage and quality of mortality data. Adjustments made to risk factors by WHO yield point estimates and 95% CI, although these results should not be overinterpreted. Confidence intervals provide the range of values consistent with the true population means or proportions, and, together with point estimates, are especially meaningful when they are produced on the basis of strong, nationally representative surveys. There are substantial limitations with respect to the quality of data presently available on a global scale to monitor non-communicable diseases. Concerted efforts are in progress to improve the coverage and quality of data for mortality and risk factors of such diseases. Because of the large adjustments needed to be made to these data by WHO, results should be interpreted with caution. WHO needs to do these complex statistical modelling exercises because too many countries presently have inadequate or incomplete data.

The ideal situation would be for countries to do regular surveys at a national scale with standardised methods, including indicators, questionnaires, and age groups, which would obviate the need for the adjustments undertaken by WHO. The same limitations apply to our monitoring of country capacity. Assessment of national capacity for non-communicable disease prevention is in development. In particular, the validity of the data we show requires further assessment. Publication of these data will be a stimulus for countries to examine and improve their data. Future assessments need to include details of chronic disease funding as a percentage of total health budget and details of the staff employed nationally and regionally to undertake prevention and control of these diseases.

In the absence of reliable data for risk factors and cause-specific mortality, accurate assessment of the effects of policy and programmes is difficult. Countries need to award higher priority to strengthening of their core data for non-communicable diseases than exists at present and improve vital registration, which is essential for achievement of high-quality mortality data.<sup>35</sup> However, in regions where vital registration is not available or inadequate from a coverage or quality perspective,

countries' Ministries of Health should consider establishment of alternative methods such as verbal autopsy<sup>36,37</sup> as an interim measure before improvements to their vital registration system can be made. Capacity building is key, and there is an urgent need for certification training for physicians and other health workers to reliably establish causes of death with the WHO international certificate and apply the rules and procedures of the International Classification of Diseases.<sup>38</sup>

We noted high rates of tobacco use for many of the 23 countries that we examined. The WHO FCTC provides the international legal foundation for countries to implement measures for tobacco control. However, the review of progress in implementation of selected demand-reduction measures suggests that progress is slow and there is still much work to be done in these 23 countries; tobacco control remains an immediate priority for prevention of non-communicable diseases in most countries.

Overweight and obesity are of public health concern in most of the 23 countries. In 2004, WHO member states endorsed the global strategy for diet, physical activity, and health to address two major risk factors—unhealthy diet and physical inactivity. Although the strategy has been in force for 6 years, the multisectoral policy response required to address obesity has been slow.

From the 2010 capacity assessment and comparison with the 2000 survey, we suggest that progress has occurred over the past decade. However, major gaps remain in the accuracy, quality, standardisation of risk factor data, and reporting of non-communicable disease outcomes such as cause-specific mortality in a large proportion of countries. Concerns about the quality and comparability of data remain, which are major challenges to overcome if comprehensive global monitoring and surveillance for such diseases is to occur.

## Conclusions

This dearth of capacity, which includes important gaps in surveillance, is a major challenge to global health development. The negative effects on health and socioeconomic development are increasingly understood and require a strong response from all countries. Recent developments, including the UN General Assembly resolution on non-communicable diseases, call for a high priority to be given to these diseases, not only within the health sector, but also within the national and global development agendas.<sup>39</sup> It calls for a high-level meeting of the General Assembly on non-communicable diseases in September, 2011, with the participation of heads of state and government. The resolution requests the UN Secretary General to submit a report on the global status of these diseases. One area of emphasis during the discussions leading to the high-level meeting in 2011 will therefore cover the need for strengthening of global monitoring of trends and approaches, for integration of non-communicable disease surveillance into national

health information systems. A key outcome of this meeting will be positioning of the prevention of such diseases as central to country development.<sup>40</sup>

The UN resolution<sup>39</sup> provides an unprecedented opportunity for countries, UN agencies, international development organisations, civil society, and the private sector to work jointly around a common vision and a road map to address the enormous chronic-disease burden that low-income and middle-income countries are increasingly facing. Challenges to prevention of non-communicable diseases, such as strengthened surveillance, more effective intersectoral action, and improved access to basic health care (including essential medicines and technologies), are key issues that are pivotal to include in the discussions over the coming months.

### Contributors

AA and DRM conceptualised and designed the study, interpreted the data, drafted and revised the report, gave final approval for publication, and are the guarantors of the paper. LMR interpreted the data and helped to draft the report, with substantial input to revisions, including the published version. ETDE, GAS, CDM, and DB helped to interpret the data and draft sections of the report.

### Conflicts of interest

We declare that we have no conflicts of interest.

### References

- 1 Abegunde DO, Mathers CD, Taghreed A, Ortegón M, Strong K. The burden and costs of chronic diseases in low-income and middle-income countries. *Lancet* 2007; **370**: 1929–38.
- 2 WHO. Preventing chronic diseases: a vital investment. Geneva: World Health Organization, 2005.
- 3 Horton R. Chronic diseases: the case for urgent global action. *Lancet* 2007; **370**: 1881–82.
- 4 Geneau R, Stuckler D, Stachenko S, et al. Raising the priority of preventing chronic diseases: a political process. *Lancet* 2010; published online Nov 11. DOI:10.1016/S0140-6736(10)61414-6.
- 5 Beaglehole R, Ebrahim S, Reddy S, Voûte J, Leeder S, on behalf of the Chronic Disease Action Group. Prevention of chronic diseases: a call to action. *Lancet* 2007; **370**: 2152–57.
- 6 WHO. WHO report on the global tobacco epidemic, 2009: implementing smoke-free environments. Geneva: World Health Organization, 2009.
- 7 WHO. Global strategy for the prevention and control of noncommunicable diseases (WHA53/14). Geneva: World Health Organization, 2000.
- 8 WHO. Framework convention on tobacco control (WHA56.1). Geneva: World Health Organization, 2003.
- 9 WHO. Global strategy on diet, physical activity and health (WHA57.17). Geneva: World Health Organization, 2004.
- 10 WHO. Action plan for the global strategy for the prevention and control of noncommunicable diseases. Geneva World Health Assembly: A61/8. Geneva: World Health Organization, 2008.
- 11 Alwan A, Maclean DR, Mandil A. Assessment of national capacity for the prevention and control of noncommunicable diseases: the report of a global survey, WHO/MNC/01.2. Geneva: World Health Organization, 2001.
- 12 WHO surveillance and monitoring. <http://www.who.int/tobacco/surveillance/en> (accessed Feb 15, 2010).
- 13 WHO. WHO STEPS surveillance manual: the WHO STEPwise approach to chronic disease risk factor surveillance. Geneva: World Health Organization, 2005.
- 14 WHO Global InfoBase. <https://apps.who.int/infobase> (accessed Feb 15, 2010).
- 15 WHO. The global burden of disease: 2004 update. Geneva: World Health Organization, 2008.
- 16 Mathers CD, Boerma T, Ma FD. Global and regional causes of death. *Br Med Bull* 2009; **92**: 7–32.

- 17 WHO. World health statistics 2010. Geneva: World Health Organization, 2010
- 18 WHO Mortality Database 2008. <http://www.who.int/healthinfo/morttables/en/index.html> (accessed Feb 10, 2010).
- 19 Black RE, Cousens S, Johnson HL, et al, for the Child Health Epidemiology Reference Group of WHO and UNICEF. Global, regional, and national causes of child mortality in 2008: a systematic analysis. *Lancet* 2010; **375**: 1969–87
- 20 Ferlay J, Shin H, Bray F, Foreman D, Mathers CD, Parkin DM. Estimates of worldwide burden of cancer in 2008: Globocan 2008. *Int J Cancer* 2010; published online June 17. DOI:10.1002/ijc.25516.
- 21 Jha P, Gajalakshmi V, Gupta PC, et al. Prospective study of one million deaths in India: rationale, design, and validation results. *PLoS Med* 2006; **3**: e18.
- 22 Registrar General of India. Causes of death in India in 2001–2003. New Delhi: Registrar General of India, Government of India, 2009.
- 23 Ministry of Health. Report on the third national retrospective survey on mortality. Beijing, China: Ministry of Health, 2008.
- 24 Porapakkham Y, Rao C, Pattaraarchachai J, et al. Estimated causes of death in Thailand, 2005: implications for health policy. *Popul Health Metr* 2010; **8**: 14.
- 25 Ngo AD, Rao C, Hoa NP, et al. Mortality patterns in Vietnam, 2006: findings from a national verbal autopsy survey. *BMC Res Notes* 2010; **3**: 78.
- 26 Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Med* 2006; **3**: e442.
- 27 World Bank. Global economic prospects, 2009. Washington, DC: The World Bank, 2009.
- 28 World Bank. Global economic prospects, 2010. Washington, DC: The World Bank, 2010.
- 29 University of Denver. International futures: exploring alternative global possibilities, 2009. <http://www.ifs.du.edu> (accessed Sept 18, 2010).
- 30 Strong K, Guthold R, Yang J, et al. Tobacco use in the European region. *Eur J Cancer Prev* 2008; **17**: 162–68.
- 31 WHO Global InfoBase Team: the SuRF report 2. Surveillance of chronic disease risk factors: country-level data and comparable estimates. Geneva: World Health Organization, 2005.
- 32 WHO. Discussion paper: noncommunicable diseases, poverty and the development agenda (July 2009) ECOSOC high-level segment 2009. [http://www.who.int/nmh/publications/discussion\\_paper\\_ncd\\_en.pdf](http://www.who.int/nmh/publications/discussion_paper_ncd_en.pdf) (accessed Aug 27, 2010).
- 33 Gaziano TA, Galea G, Reddy KS. Scaling up interventions for chronic disease prevention: the evidence. *Lancet* 2007; **370**: 1939–46.
- 34 World Economic Forum. Global risks 2010: a global risk network report. <http://www.weforum.org/pdf/globalrisk/globalrisks2010.pdf> (accessed Aug 27, 2010).
- 35 Mahapatra P, Shibuya K, Lopez AD, et al, on behalf of the Monitoring Vital Events (MoVE) writing group. Civil registration systems and vital statistics: successes and missed opportunities. *Lancet* 2007; **370**: 1653–63.
- 36 Baiden F, Bawah B, Biai S, et al. Setting international standards for verbal autopsy. *Bull World Health Organ* 2007; **85**: 569–648.
- 37 WHO. Verbal autopsy standards: ascertaining and attributing cause of death. Geneva: World Health Organization, 2007.
- 38 WHO. International statistical classification of diseases, 10th revision, 2nd edition. Geneva: World Health Organization, 2005.
- 39 UN General Assembly. Resolution on noncommunicable diseases, A/RES/64/265. Geneva: United Nations General Assembly, 2010.
- 40 Alleyne G, Stuckler D, Alwan A. The hope and promise of the UN resolution on noncommunicable disease. *Global Health* 2010; **6**: 15.