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Management of Noncommunicable Disease in Low- and Middle-Income Countries

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Abstract

Noncommunicable disease (NCD), comprising cardiovascular disease, stroke, diabetes, and chronic obstructive pulmonary disease, are increasing in incidence rapidly in low- and middle-income countries (LMICs). Some patients have access to the same treatments available in high-income countries, but most do not, and different strategies are needed. Most research on noncommunicable diseases has been conducted in high-income countries, but the need for research in LMICs has been recognized. LMICs can learn from high-income countries, but they need to devise their own systems that emphasize primary care, the use of community health workers, and sometimes the use of mobile technology. The World Health Organization has identified “best buys” it advocates as interventions in LMICs. Non-laboratory-based risk scores can be used to identify those at high risk. Targeting interventions to those at high risk for developing diabetes has been shown to work in LMICs. Indoor cooking with biomass fuels is an important cause of chronic obstructive pulmonary disease in LMICs, and improved cookstoves with chimneys may be effective in the prevention of chronic diseases.

The world has made good progress in reducing deaths from infectious communicable disease, but this success has paved the way for the pandemic of noncommunicable disease (NCD). NCD, specifically cardiovascular disease, diabetes, chronic obstructive pulmonary disease (COPD), and some cancers, now account for two-thirds of global deaths, 38 million a year [1]. Four-fifths of those deaths occur in low- and middle-income countries (LMIC)

[1]. Without concerted action, deaths from NCD are expected to increase by 15% between 2010 and 2020, with the biggest increases being in Africa, the eastern Mediterranean, and Southeast Asia. Half of the deaths in LMICs occur in people age < 70 years, but at least half of premature deaths from NCD are preventable [1,2].

Recognition of this pandemic led the United Nations to hold its second ever high-level meeting on health on NCD in September 2011 [3]. The World Health Organization (WHO) has now set a target to reduce deaths from NCD in people age < 70 years by 25% by 2025. Most LMICs are currently not well equipped to respond to NCD. Most research on NCD has been conducted in high-income countries, but the need for research in LMICs has been recognized [4] This report combines the experience of many clinicians and researchers from LMICs who have been conducting research on NCD and the priorities for reducing the burden of NCD. It is aimed at clinicians at all levels and policy makers in LMICs. The focus is on cardiovascular disease, stroke, diabetes, and COPD.

Methods

Most of the authors of this review are clinicians managing patients or public health specialists attending to NCD in Asia, Africa, and Latin America. We are joined in a network of 11 centers funded by the U.S. National Heart, Lung, and Blood Institute and the UnitedHealth Chronic Disease Initiative to undertake research, build capacity, and develop policy to counter NCD [3]. Most research on NCD has been conducted in high-income countries, but the need for research in LMICs has been recognized [4]. We have supplemented our clinical, epidemiological, and public health knowledge with extensive reading, concentrating wherever possible on systematic reviews and studies undertaken in or relevant to LMICs. We began by developing a structure for the overall paper and then dividing the topic into cardiovascular disease, stroke, diabetes, and COPD. Teams with firsthand experience managing relevant patients, addressing preventive strategies for specific conditions, or both prepared a draft for each section. The sections were then combined and edited, and all authors reviewed the entire report.

A Systematic Response to NCD in LMIC

Clearly the NCD pandemic is one of the biggest health challenges faced by humankind. A common thread in LMICs relates to rapidly changing context, both in terms of growing populations and life-styles. High-income countries faced these life-style changes many decades ago, and the changes occurred slowly, over several decades. In a way, there was enough time to understand the challenges, and health systems were able to adapt. The relative abundance of resources, together with settings with smaller populations relative to LMICs, allowed the implementation of a host of strategies at various levels. Public health measures and education of the population were central to the efforts toward successful mitigation of the impact of NCDs in high-income countries. In LMICs, the rapidity of changes, the scale of the changes, and the massive populations involved have rapidly outstripped health care systems, and available infrastructure is simply unable to cope. The challenges are diverse and complex.

Because most LMICs do not have the extensive health systems of high-income countries, they do not have the option to simply copy the systems that have emerged in high-income countries. Thus, they must develop more cost-effective and equitable ways of countering NCD. Table 1 lists our ideas on what such a system in an LMIC might look like. We acknowledge, however, that because of political challenges, it might not be easy to achieve.

Cardiovascular Disease

Prevention

A recent analysis of global trends in systolic blood pressure [5] found that although there has been a fall globally since 1980, the decline has been greatest in high-income countries, whereas it has increased in some LMICs. This observation illustrates one of the many challenges [6] faced by LMICs in dealing with cardiovascular disease.

Before the United Nations meeting, the NCD Alliance, which includes some 2,000 organizations from around the world, set out 7 priorities for preventing NCD (Table 2) [7], and these have recently been supported by the ministers of health of Central American nations, who prioritized the first 5 [8]. The optimal national prevention program would be to integrate the 7 policy initiatives with a public education campaign [9], as happened in Mauritius [10]. Such a program includes most of the WHO's “best buys” for reducing the economic impact of NCD in LMIC (Tables 3 and 4) [11]. Unfortunately this approach poses political and financial challenges for most LMICs. More feasible alternatives include community-based programs on salt reduction [12,13], life-style interventions [14–16], and secondary prevention with multidrug treatment of hypertension and diabetes [17,18].

The evidence for the cost-effectiveness of interventions in LMICs is growing but remains scarce and is biased toward pharmaceutical interventions [19]. As Suhrcke et al. [19] correctly pointed out, “considerable caution should be exercised when transferring effectiveness estimates from developed countries for the purpose of modeling cost effectiveness in developing countries.” This word of caution illustrates an important limitation of recent cost-effectiveness exercises published by the WHO in the *BMJ* [20–22].

Ideally, community-based interventions should be comprehensive and multifaceted [23]. Other possibilities include programs in schools to encourage healthy life-styles and programs in children [24] to reduce cardiovascular risk factors such as physical inactivity, obesity, and diabetes. Focusing on nutrition of pregnant mothers and children should produce long-term benefits, as both under- and overnutrition have been shown to have long-term consequences, particularly in the context of NCDs. These adverse consequences result from biological (fetal programming and epigenetic changes) and social mechanisms.

For LMICs, prevention remains both a priority and a weakness. For most countries, there is still the golden window of opportunity to avoid larger burdens from NCD, but political will may be lacking and resources constrained. When difficult choices must be made, country-specific priorities need to be considered, such as tobacco control in China [25] and obesity prevention in Mexico [26].

Identifying those at risk

Identification of individuals at high risk for cardiovascular events will also be needed [8], and in some resource-limited settings, non-laboratory-based methods are preferable [27,28]. In a recent modeling study, which assumed a developed country type of baseline scenario for NCD, Wald et al. [29] showed that screening for future events by age alone yielded detection and false-positive rates comparable with the accuracy of current more expensive, methods.

The search for simplicity in identifying those at high risk, if effective, will point to strategies that should have high priority. For example, the Chinese government has begun to promote a strategy to screen for high blood pressure in all patients ≥35 years of age seen at primary care facilities. A similar strategy is being tried in Kenya, where health workers who visit homes to test for human immunodeficiency virus infection are now also measuring blood pressure and blood glucose. It remains to be shown whether these strategies will be cost effective in detecting hypertension. Those proposing to scale up any of these proposals need to understand the complexities, which include (1) an epidemiology of unfinished agendas of infectious diseases and undernutrition, together with NCD and injuries; (2) fragmented health systems and human resources constraints; and (3) transitioning societies, particularly the role of migration, unplanned urbanization, and population and economic growth.

Diagnosis

Early and accurate diagnosis of cardiovascular disease is an important step for control. Although mass screening approaches are neither cost effective nor feasible, there are demonstrated needs in LMICs to develop and adopt affordable and effective point-of-care innovative diagnostic tools, devices, and technology. These should be suitable for use in primary care settings and for use by community health workers for better screening and diagnosis of cardiovascular disease.

Management

Structural change to health care systems is also important. A primary care approach based on a trained primary care team may provide an efficient and equitable solution and has shown some promising results [30–33]. Integrated care, defined as the joint participation of generalist and specialist care physicians in the planned delivery of care for patients with chronic conditions [34,35], is widely advocated [36]. A recent Cochrane systematic review identified 20 studies, 19 of which were randomized clinical trials, of shared care interventions for chronic disease management, with mixed results [37]. Nevertheless, collaborative care seems to be a good way to seek a greater role for nonmedical providers to provide primary care within the formal health sector.

There is mounting evidence for the role of community health workers in increasing the capacity of overburdened health care systems by using resources more effectively and so increasing access, coverage, and the quality of care [38,39]. In rural settings, primary care systems with trained community health workers and well-established guidelines can be effective in the prevention and management of cardiovascular disease, as evidence from Iran suggests [40,41]. The addition of community health workers to clinical teams addresses

systems-level barriers to prevention and control by simplifying the physician's tasks and transferring some responsibility for patient care. These team changes have resulted, in 20 studies, in a median reduction in systolic blood pressure of 9.7 mm Hg and, in 24 studies, a reduction in diastolic blood pressure of 4.2 mm Hg [42]. Moreover, community health workers may remove the barriers to blood pressure control and medication adherence resulting from cultural, educational, and language differences between patients and the health care system [43]. A systematic review of randomized trials using community health workers to implement blood pressure control programs found significant improvement in 7 of 8 studies, primarily in poor, urban, minority communities [44].

One of the most pressing challenges for LMICs is increasing comorbidity as a result of aging and more effective treatment, with burdens concentrated in certain high-risk groups [45]. Interventions to tackle single health problems such as type 2 diabetes [46] and coronary heart disease [47,48] have been shown to be effective [19,22]. Nevertheless, multifaceted approaches to reshape care management [17] should be explored, including interventions using mobile phones, which are showing promise in developed countries [49,50]. Mobile phones are common in LMICs, even among the poorest, but so far systematic reviews have shown effectiveness only for specific conditions, such as the use of text messaging for reminders [51,52].

Better self-management is needed for cardiovascular disease, but the challenges to increasing it in LMICs include lack of access, less health education, overreliance on and yet lack of trust in health care professionals, cultural barriers to adopting evidence-based measures (such as resistance to taking Western medicine in China), resource constraints, and competing demands on patients with cardiovascular disease. Innovative ways for more effective enabling of patient self-management are needed. Community health workers could also provide a platform for education in the home, as shown in Pakistan [17], which may also facilitate the application of successful home blood pressure monitoring in LMICs [53–55].

Stroke

Stroke is the second leading cause of death worldwide and the leading cause of acquired disability [56]. Up to 85% of strokes worldwide occur in LMICs [57,58], and the incidence of hemorrhagic strokes is higher in those countries than in high-income countries [59]. Several subtypes of stroke have been identified using modern neuroimaging, which is widely available [60]. INTERSTROKE, an international multicenter case-control study recruiting cases of first stroke from both LMICs and high-income countries, reported that modifiable risk factors such as hypertension, smoking, waist-to-hip ratio, diet, and alcohol intake account for 90.3% (95% confidence interval: 85.3% to 93.7%) of all strokes across the world [61,62].

Screening and surveillance

Some LMICs have realized the importance of stroke screening and taken action. In East Asia, China launched the Stroke Screening, Prevention and Treatment Project in 2009 [63]. The WHO recommends a stepwise stroke surveillance approach (STEPS Stroke) following 3

steps to stroke data collection: step 1, information on stroke patients admitted to health facilities; step 2, identification of fatal stroke events in the community; and step 3, estimates of nonfatal stroke events in the community [64]. A study synthesizing STEPS Stroke surveillance at 9 sites in India, Iran, Mozambique, Nigeria, and Russia showed that STEPS Stroke surveillance is possible and feasible in low-resource settings [65]. However, a systematic evaluation of 7 STEPS Stroke surveillance studies in 9 LMIC indicated inadequate adherence to standardized surveillance methodology [66].

Primary prevention

Prevention and treatment strategies for stroke are similar to those for cardiovascular disease, because of common risk factors and shared etiology. Hence, the main approaches for stroke's primary prevention are promoting and maintaining a healthy life-style and blood pressure control, which applies to both ischemic and hemorrhagic stroke. A healthy life-style includes not smoking (and smoking cessation for smokers), no binge drinking, being physically active, and a healthy diet characterized by adequate fruit and vegetable intake, reduced intake of dietary trans fats, and reduced sodium intake [67]. Healthy life-style is closely linked to prevention and control of overweight and obesity, which can also affect a large number of chronic conditions, including stroke, and is achieved mainly through behavioral interventions targeting diet and physical activity [68].

Acute management

Awareness of the symptoms and causes of stroke is poor in most LMICs, which is an important barrier for implementing effective strategies for prevention and early treatment. There are several gaps seen in the acute management of stroke in LMICs [69,70]. A Cochrane review showed that recombinant tissue plasminogen activator administered within 6 h of symptom onset reduces death and dependency [71], but there is controversy about its cost-effectiveness in LMICs [72].

A multidisciplinary approach is needed for optimal management and rehabilitation of patients with acute stroke [73,74]. Patients managed in specialized stroke units have better survival and functional ability [75–78].

Worldwide, there is low use in patients with stroke of effective medications such as statins, antihypertensive agents, and antiplatelet drugs [79]. Among 5,650 people ages 35 to 70 years with stroke or coronary artery disease from high-income countries as well as LMICs, only 25% were on antiplatelet drugs, 17% on β-blockers, 20% on angiotensin-converting enzyme inhibitors or angiotensin receptor blockers, and just 15% on statins [79]. Treatment rates are extremely low in LMICs [79].

Secondary prevention

There is an urgent need to develop robust strategies for early identification, acute care, and rehabilitation of patients with stroke that can be implemented on a large scale. Using a single pill that combines the effective drugs might improve prescribing rates among doctors and adherence by patients at high risk for stroke and may be cost effective [80]. Trials are under way to test this concept [81–83].

Involvement of community health workers to raise stroke awareness and offer psychological support is being tested [84]. These tests have not yet shown improved clinical outcomes, but patients in the intervention group were satisfied that there was someone to listen to them and explain their symptoms and treatment [84]. Improving general awareness of the need to adopt a healthier life-style and adhere to medications can significantly lower the risk for stroke [85–89], while early provision of care reduces mortality [75–78]. In addition, patients with stroke experience reactive depression and social disconnection, which have an impact on their clinical outcomes and return to society. Stroke in the young is more common in LMICs, and this population can benefit greatly from early and continuing functional rehabilitation [90–104].

Effective interventions are needed to improve public awareness of stroke and stroke prevention. In addition, referral mechanisms are needed to improve the timing and the quality of care in patients with stroke [84]. These developments can shorten the time from the onset of symptoms to presentation to the hospital, especially in rural settings [84]. Increased awareness could also improve adherence to rehabilitation and treatments for secondary prevention. Policy makers need to be better informed to allocate resources for prevention and to widen access to stroke units and rehabilitation. These efforts combined can in the long run substantially reverse the rising trends in both stroke incidence and mortality [58].

Diabetes

In 2012, LMICs were already home to 4 of 5 patients with diabetes globally [95]. Projections for 2030 are that the number of patients with diabetes will increase by 186 million [95]. India and China are estimated to contribute 48% of this number, while other LMICs will also contribute, for example, the Middle East, which has recorded the highest increase in disease prevalence: 6 of the 10 nations with the highest population prevalence come from this region [95,96]. The diabetes burden in Latin American, Caribbean, and African settings, despite projected rises, is based on limited surveillance and data [95,97]. Given the global distribution of diabetes, it is unsurprising that LMICs contribute the majority of global deaths and disability-adjusted life-years (DALYs) lost because of high blood glucose [98].

Aging, urbanization, changing life-styles leading to inactivity, and easy availability of low-cost, calorie-rich, fatty fast foods among rich and poor have spurred growth in obesity and consequently increased diabetes rates, especially among the economically productive age group [99–108]. Urban migrants have higher obesity rates, higher intake of fat, and lower physical activity compared with their rural counterparts [107,108]. The nutrition transition [109] leads to a larger intake of sugars and oils and lower consumption of fruit and vegetables, which are expensive [103,110,111]. Furthermore, there are rising rates of physical inactivity, even in LMICs [112]. A variation in the relationship between body mass index and risk for glucose intolerance has been observed in different ethnic groups, with South Asians showing a higher risk for diabetes at low body mass index. This supports the need to redefine the at-risk body mass index cutoffs for these populations [113,114], not only in adults but also in children [115–118].

The thrifty phenotype hypothesis, proposed by Hales and Barker [119], suggests that poor nutrition during pregnancy may predispose the developing fetus to metabolic disorders later in life if adequate or excessive nutrient resources are available. Low birth weight and undernutrition in childhood are contributing risk factors for high blood glucose concentration and diabetes later in life [118,120–122]. Studies of fast catch-up growth in India and South Africa have shown that preadolescent children with low birth weight demonstrate early signs of impaired glucose tolerance [123,124].

Socioeconomic and educational status also affects the evolution of NCD in LMICs, with disease first affecting the more affluent but subsequently also increasing among the poor [125,126]. The poor are less aware of the diseases, are diagnosed later, and have less access to health care, especially in rural areas [103,127–130].

Screening and diagnosis

Screening for high-risk individuals and diagnosing in various settings can be based on a risk score using questionnaires or from routinely collected information including, for example, age, waist circumference, family history of diabetes, and blood pressure. However, risk scores generally do not perform as well in populations other than those in which they are derived and require validation in each population [131–135]. Once people at high risk have been identified, more definitive tests to diagnose diabetes can be used, such as measurement of fasting blood glucose levels, the more cumbersome oral glucose test, or glycated hemoglobin, which although convenient is expensive and less commonly available in these settings. Furthermore, there are suggestions that the cut points for diagnosing diabetes using glycated hemoglobin may differ in non-Caucasians [136–138].

Prevention

To date diabetes prevention strategies have focused on the high-risk approach, that is, identification of those at high risk followed by life-style or pharmacological interventions or both, strategies that have been shown to work in LMICs [139–145]. The alternative or parallel approach of shifting the risk-factor profile in the population—for example, reducing levels of obesity through multisectoral policies and initiatives—although formally untested is highly rational and also needs to be pursued [146].

Treatment

The aims of diabetes care are clear and do not differ between high-income countries and LMIC. Numerous health care interventions, such as screening for retinopathy and nephropathy with appropriate actions, are highly cost effective, while multifactorial interventions such as control of blood pressure, glycemia, and lipids prevent vascular complications of diabetes [147,148]. Yet clinical diabetes management is complex in any setting and is particularly challenging in LMICs given the lack of trained personnel, inadequate equipment for routine monitoring and screening for complications, and limited access to medication in primary care [101,149–151].

The process of establishing national diabetes programs started 20 years ago with a WHO resolution and has since been extended by a United Nations resolution, giving hope that they

will form the nidus of the global fight against diabetes, including in LMICs. Recently, a survey of the 202 International Diabetes Federation member associations found that 61% of the 89 countries that responded reported having national programs, although activities were limited in Southeast Asia and Africa [152].

National NCD surveillance systems are essential in LMICs to enable the organization of diabetes care in primary health care and to define referral pathways, plan drug delivery, and promote adherence. Lessons learned from the successful models of care for human immunodeficiency virus infection and acquired immune deficiency syndrome can be applied to the care for people with diabetes, and in this context the use of community health workers and innovative mobile phone technologies should be considered [153].

In sum, diabetes prevention efforts should be targeted at the population level and linked with efforts to reduce cardiovascular disease in general. Countries should consider implementing national programs for NCD, including diabetes, with management involving both integration with existing health care facilities and the creation of new care delivery systems.

Chronic Obstructive Pulmonary Disease

COPD is a leading cause of morbidity and mortality in LMICs, yet many governments in these countries have not recognized its importance and have assigned it a lower priority for intervention than other diseases. In 2001, COPD was responsible for 2.4 million deaths (approximately 5% of total deaths) and 33 million DALYs lost in LMICs [154], and it is projected that by 2020, COPD will be the fourth leading cause of DALYs lost in LMICs [155]. In China alone, for example, COPD is expected to kill 65 million people between 2003 and 2033 [156]. Globally, the estimated population prevalence of COPD among adults is 10% [157]. This number is expected to increase with an aging population [157,158], but COPD is both treatable and preventable. Targeted policies in LMICs may provide cost-effective strategies, including primary and secondary preventive programs against tobacco smoke and the use of solid fuels [157–159], culturally appropriate adaptation of existing guidelines for diagnosis and standardized case management [160–162], increased access to medicines [163,164], and better education of health workers.

Diagnosis

COPD should be suspected in any adult with dyspnea, chronic cough or sputum production, and a relevant exposure history (Table 5). The disease is characterized by airflow limitation that is not fully reversible, which can be easily quantified with spirometry before and after bronchodilators. The Global Initiative for Chronic Obstructive Lung Disease has developed a universally applicable classification system for COPD that includes post-bronchodilator spirometry [165], but there are several challenges that may limit the applicability of this classification system in LMICs.

First, spirometry requires the availability of spirometers and the technical skill to use them, both of which may be lacking in resource-poor settings. A potential solution to this problem is the wider use of pocket spirometers, which are relatively inexpensive compared with standard office spirometers or diagnostic-quality spirometers (about $100 versus $1,000

versus $20,000), require less training, and are easier to use and may be a useful tool for screening in COPD [166]. In our experience, training nonmedical personnel to perform high-quality spirometry is not difficult [167].

Second, interpretation of severity with the Global Initiative for Chronic Obstructive Lung Disease classification system requires local reference equations for lung function, which are not available in many LMICs. But ethnically appropriate reference equations can be developed relatively easily once infrastructure is in place. Finally, in the absence of spirometry other indicators may be useful to increase suspicion of COPD, including peak expiratory flow < 70% [168] and a prolonged forced expiratory time [169,170].

Prevention

Although tobacco smoke is recognized as one of the most important risk factors for COPD worldwide, other risk factors that are highly preventable in LMICs may contribute an equal or even greater share of the burden of COPD (Table 5). For example, a recent meta-analysis found that exposure to biomass fuel smoke is associated with a doubling in the risk for COPD [171], and because more than half of the world's population uses biomass fuels indoors for cooking, exposure to biomass fuel smoke is probably the most important population-attributable risk factor for COPD [172,173]. Exposure to biomass fuel smoke is estimated to be responsible for 1.6 million deaths and 38.5 million DALYs lost each year and to explain about 4% of the global burden of disease [174].

Over the past 5 years, there has been a strong response by governmental and international organizations to develop global strategies for the universal adoption of clean cookstoves and fuels [175], but many of the efforts have focused on fuel efficiency rather than health effects by using rocket stoves that do not ventilate emissions out of the house. Moreover, many of the improved rocket stoves currently available provide only a single burner, which limits their use by large families, obliging them to continue using their traditional open-fire cookstoves. Improved cookstoves seem to achieve reductions of about 40% to 80% in particulate matter of 2.5 $\mu g/m^3$ [171,175–180], but the resulting concentrations are still 2 to 7 times higher than those recommended by the WHO [181]. Variations in particulate matter reduction are strongly dependent on the cookstove design (e.g., chimney vs. no chimney), types of available fuels (e.g., wood, dung, charcoal, agricultural crop waste), maintenance of both stove and chimney, and other local preferences. There is thus an urgent need for randomized trials using different designs of improved cookstoves vented to the exterior or gasifier stoves to determine the true range of potentially achievable reductions, their long-term benefits in reducing the burden of COPD, and the likelihood of their use.

Management

The Global Initiative for Chronic Obstructive Lung Disease guidelines also provide a comprehensive approach to the standardized case management of COPD [165], but a full-scale implementation of these guidelines is untenable in many LMICs. Instead, a more selective approach should be considered. A recent publication evaluated the cost-effectiveness of several interventions to combat COPD in Asia and Africa and found that inhaled bronchodilators (with or without corticosteroids) were the most cost-effective

strategies and would avert the greatest number of DALYs lost for the treatment of COPD [182]. The next most cost-effective strategies were smoking cessation and influenza vaccination [182]. Other cost-effective interventions include the use of spacers for metered-dose inhalers, oral bronchodilators when inhaled bronchodilators are too expensive or unavailable, and simplified pulmonary rehabilitation programs [183]. Finally, there is still an opportunity to identify settings in LMICs where primary prevention of tobacco smoking may be successful at maintaining a low prevalence of tobacco smoking [184].

Summary

As deaths from infectious diseases and in early life decline, health systems in LMICs will increasingly need to manage patients with NCD. Most health systems are currently not well prepared to manage the pandemic, but, as we hope we have shown, there are many low-cost ways to prevent, diagnose, and treat NCD. Health authorities in LMICs will achieve maximum cost-effectiveness and equity by learning from but not copying models developed in high-income countries and other LMICs and by devising their own policies.

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Appendix

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Table 1

A systematic response to NCD in LMICs

Each country would have a standing high-level task force to counter NCD that includes all relevant government departments (not simply health but finance, agriculture, trade, environment, education, etc.) and civil society, academia, and the private sector. One of the main messages to come from the UN meeting was that health systems alone could not counter NCD; rather, a "whole of government and whole of society" response is needed.
The emphasis should be not on clinical care by specialists in hospitals, as in developed countries, but rather on public health and preventive measures, concentrating not on education alone but on structural changes such as raising the prices of alcohol and tobacco, banning smoking in public places, taxing sugar-sweetened beverages, and designing transport systems that encourage physical activity.
Citizens and patients rather than clinicians should be "in charge" and recognize that they can achieve much higher levels of health by taking responsibility for their care rather than depending passively on clinicians. This might sound like an odd strategy for often deprived populations, but such populations have had to develop considerable personal resources to survive and flourish.
Whenever possible, health care should be provided within primary care.
Community health workers can provide most care.
There should be extensive use of standardized protocols and guidelines.

LMIC, low- and middle-income country; NCD, noncommunicable disease; UN, United Nations.

Table 2

Priorities for preventing cardiovascular disease as set out by the NCD Alliance before the United Nations meeting

1.	Act on childhood obesity.
2.	Reduce saturated fats, trans fats, salt, and refined sugars in processed foods.
3.	Provide incentives for production, distribution, and marketing of vegetables, fruit, and unprocessed food.
4.	Develop policies to encourage walking, cycling, and other physical activities.
5.	Improve environmental (including indoor air pollution), occupational, and other contextual risk factors for NCD.
6.	Accelerate implementation of the Framework Convention on Tobacco Control.
7.	Provide effective population-wide early detection of those at risk, screening, and programs to raise awareness.
8.	Take action to reduce the harmful use of alcohol.

NCD, noncommunicable disease.

Table 3
WHO public health "best buys" for preventing NCD

Protecting people from tobacco smoke and banning smoking in public places
Warning about the dangers of tobacco use
Enforcing bans on tobacco advertising, promotion, and sponsorship
Raising taxes on tobacco
Restricting access to retailed alcohol
Enforcing bans on alcohol advertising
Raising taxes on alcohol
Reduce salt intake and salt content of food
Replacing trans fats in food with polyunsaturated fat
Promoting public awareness about diet and physical activity, including through mass media

NCD, noncommunicable disease; WHO, World Health Organization.

Table 4
WHO health system “best buys” for countering NCD

Counseling and multidrug therapy, including glycemic control for diabetes for people >30 years of age with 10-year risk of 20% for cardiovascular events
Aspirin therapy for acute myocardial infection
Screening for cervical cancer beginning at age 40 years, with removal of any cancerous lesions
Biennial mammography for women 50–70 years of age
Early detection of colorectal and oral cancer
Treatment of persistent asthma with inhaled corticosteroids and β_2 agonists

NCD, noncommunicable disease; WHO, World Health Organization.

Table 5
Risk factors for COPD in HICs and in LMICs

	Prevalence	
Risk factor	**HICs**	**LMICs**
Cigarette smoke	High	Variable, ranging from low [31] to high according to the settings
Biomass fuel smoke	Low to nonexistent	High
Outdoor air pollution	High	High in urban areas (less regulation of traffic-related pollution than in HICs), low in rural areas
Occupational exposures	Low (better regulations and controls for workers)	Likely several-fold higher than in HICs because of fewer safety measures for workers
Pulmonary tuberculosis	Low	High
Lower respiratory tract infections in early childhood	Low	High
Poorly controlled asthma	Low	Higher than in HICs because of lack of access to both medical care and treatments [32]
Malnutrition	Low	High

COPD, chronic obstructive pulmonary disease; HIC, high-income country; LMIC, low- and middle-income country.