

Non-Communicable Diseases 3



Inequalities in non-communicable diseases and effective responses

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In most countries, people who have a low socioeconomic status and those who live in poor or marginalised communities have a higher risk of dying from non-communicable diseases (NCDs) than do more advantaged groups and communities. Smoking rates, blood pressure, and several other NCD risk factors are often higher in groups with low socioeconomic status than in those with high socioeconomic status; the social gradient also depends on the country's stage of economic development, cultural factors, and social and health policies. Social inequalities in risk factors account for more than half of inequalities in major NCDs, especially for cardiovascular diseases and lung cancer. People in low-income countries and those with low socioeconomic status also have worse access to health care for timely diagnosis and treatment of NCDs than do those in high-income countries or those with higher socioeconomic status. Reduction of NCDs in disadvantaged groups is necessary to achieve substantial decreases in the total NCD burden, making them mutually reinforcing priorities. Effective actions to reduce NCD inequalities include equitable early childhood development programmes and education; removal of barriers to secure employment in disadvantaged groups; comprehensive strategies for tobacco and alcohol control and for dietary salt reduction that target low socioeconomic status groups; universal, financially and physically accessible, high-quality primary care for delivery of preventive interventions and for early detection and treatment of NCDs; and universal insurance and other mechanisms to remove financial barriers to health care.

Introduction

Non-communicable diseases (NCDs) cause 35 million of the 53 million annual deaths worldwide; more than three-quarters of these deaths occur in low-income and middle-income countries.^{1,2} A substantial amount of the worldwide NCD burden is attributable to behavioural, dietary, environmental, and metabolic risk factors^{3–5}—a fact that has attracted worldwide attention to NCDs as a major global health issue and has shown the need for improved prevention and treatment.¹ In particular, NCDs were the subject of a UN high-level meeting in September, 2011. Goals and targets for NCD mortality and risk factors have been proposed, and mechanisms envisioned to increase accountability to the commitments made by measurement and reporting of progress in NCD outcomes, risk factors, and treatment.^{6,7}

Several studies, mainly from high-income countries, have shown that NCD rates are higher in disadvantaged and marginalised people and communities than in groups with higher socioeconomic status.^{8–25} Less is known about within-country NCD inequalities in low-income and middle-income countries, and about how inequalities differ in relation to the stage of economic and epidemiological development. Furthermore, within-country NCD inequalities have not received explicit attention in global NCD discussions. Although the Millennium Development Goals (MDGs) do not specifically address within-country equity, social inequalities in MDGs and their interventions are large, and reduction of these inequalities will help to achieve the

MDGs.²⁶ The scarcity of similar worldwide evidence for NCDs creates difficulties in formulation and implementation of actions that reduce NCD inequalities, and in assessment of how these actions might help to decrease the total NCD burden.

Key messages

Key actions to reduce non-communicable diseases (NCDs) and NCD inequalities, globally and within countries, are:

- Enhancement and improvement of early childhood development programmes and education for all social groups, and removal of barriers to secure employment
- Taxation of tobacco and alcohol, regulation of their production and sales, and restriction of advertising and marketing of these products
- Reduction of dietary salt intake by regulation, well-designed public education, and mass media campaigns that target disadvantaged and marginalised social groups, and perhaps negotiated voluntary actions by food manufacturers
- Improvement of financial and physical access of disadvantaged and marginalised social groups to healthier diets, including fresh fruits and vegetables, healthy fats, and whole grains through subsidies, agricultural policies, and possibly through improved availability in grocery stores; and implementation of taxes and regulations or restrictions of foods that contain high amounts of sugars, processed carbohydrates, and saturated fats
- Implementation of universal, financially and physically accessible, high-quality primary care to reduce NCD risk factors through clinical interventions and to enhance early detection and treatment of NCDs
- Implementation of universal health insurance or other mechanisms to remove financial barriers to health care, reduction of physical and behavioural barriers to health-care use, and improvement of quality of care in disadvantaged communities

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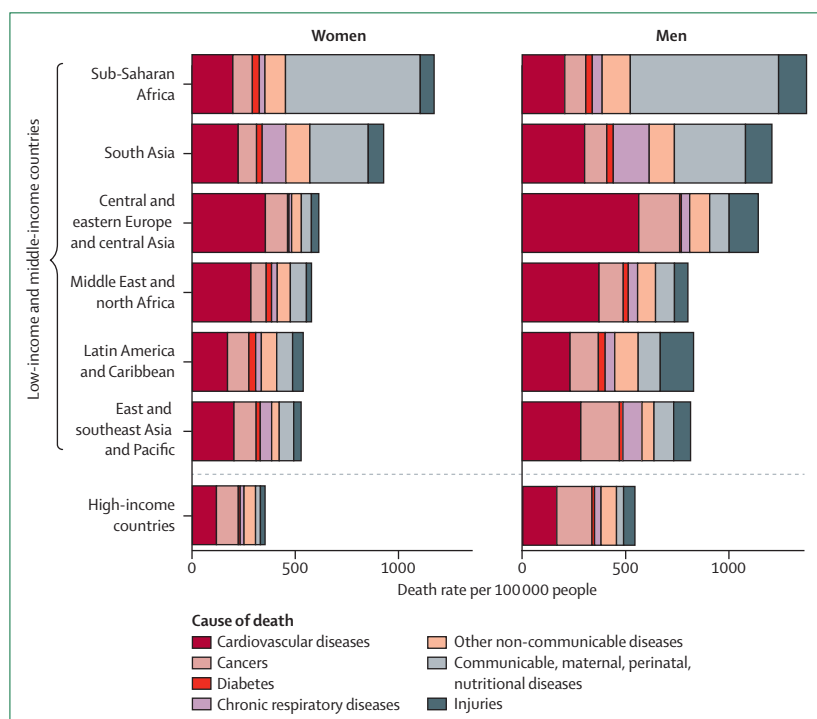


Figure 1: Age-standardised death rates by region in 2010
Data from Lozano and colleagues.⁷ Death rates are for all ages, and were standardised with the WHO standard population.²⁷

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We provide an overview of global and within-country inequalities in NCD outcomes, risk factors, and interventions, with examples from countries at all stages of economic development and in different regions. Although we discuss NCDs in general, in examples we refer specifically to cancers, cardiovascular diseases, diabetes, and chronic respiratory diseases—four disease groups that together account for more than 80% of NCD deaths and are included in global goals.⁶ We then focus on effective actions to reduce NCD inequalities.

Global inequalities in NCDs

NCD outcomes

NCDs are often thought to increase with affluence and westernisation. In reality, this notion applies only to some NCDs, such as colorectal and breast cancers, which are more prevalent in high-income than in low-income countries. The rise in crude death rates from other NCDs as economic development progresses is mainly attributable to population ageing. The age-standardised death rate for most NCDs is lower in high-income countries than in low-income and middle-income countries (figure 1). Worldwide, the age-standardised NCD death rate in men is highest in eastern and central Europe and central Asia, mainly because of very high cardiovascular disease death rates; in women, this rate is highest in south Asia, mainly because of high cardiovascular and chronic respiratory disease death rates. NCDs account for between 8% (sub-Saharan Africa) and 85% (central and eastern

Europe and central Asia) of the total differences in age-standardised death rates between low-income and middle-income regions and high-income countries (figure 1). The contribution of NCDs to the all-cause mortality gap between these countries is more than 50% in all regions, except for sub-Saharan Africa and south Asia (for both sexes) and Latin America (men only). If adults in all regions had the same mortality from cancers, cardiovascular diseases, chronic respiratory diseases, and diabetes as did those in high-income countries, global mortality from these four diseases would be reduced by 27% for men and 29% for women, which would surpass the global NCD goal of a 25% reduction in mortality worldwide.

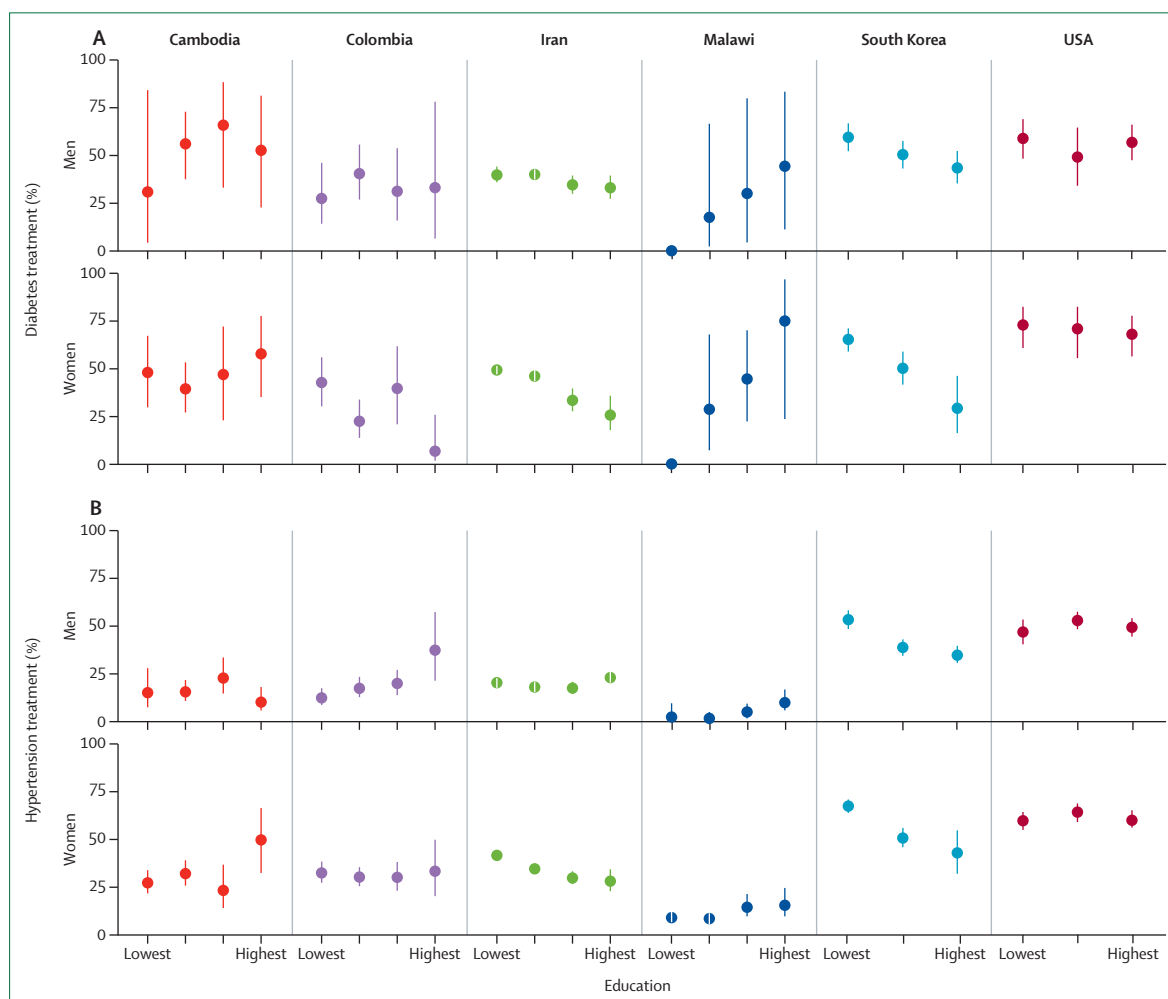
NCD risk factors

Major NCD risk factors are also increasingly concentrated in low-income and middle-income populations. Smoking prevalence in men is now highest in central and eastern Europe, and in parts of east and southeast Asia.¹ Central and eastern Europe and parts of Latin America also have the highest NCD burden associated with harmful alcohol consumption.⁵ Blood pressure has decreased in high-income countries, but has stayed the same or increased in low-income and middle-income countries.²⁸ Consequently, people in central and eastern Europe and sub-Saharan Africa have the highest blood pressure levels, which are at least 10 mm Hg higher than those recorded in high-income regions.²⁸ Rates of overweight and obesity in Oceania, the Middle East, Latin America, and southern Africa now exceed those in most high-income countries.²⁹ Raised cholesterol is now the only risk factor that is still highest in high-income countries.³⁰

Additionally, low-income countries have the extra burden of substantially higher levels of NCD risk factors that are typically associated with poverty, including use of biomass fuels and coal for cooking and heating, which are risk factors for chronic obstructive pulmonary disease and lung cancer; fetal and early childhood under-nutrition, which are risk factors for cardiovascular and metabolic diseases in adult life; and infections that can lead to rheumatic heart disease, cardiomyopathy, heart failure, and cancers of the cervix, liver, stomach, and other sites.³¹

NCD healthcare

People in low-income and middle-income countries have less access to NCD care and treatment, especially to primary care, which can effectively reduce some NCD risk factors and prevent advanced-stage disease and complications at relatively low cost by early detection and treatment. An overview of NCD care, management, and treatment through the health system is provided in *WHO's Global Status Report on Noncommunicable Diseases 2010*⁶ and in the reports on essential medicines for NCDs³² and health-system integration³³ in this Series. One example of global inequality in primary care



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Figure 2: Diabetes and hypertension treatment coverage by education level in adults aged 25–64 years in selected countries

This figure shows treatment coverage in all people with diabetes (A) or hypertension (B), irrespective of whether the disorders are diagnosed or undiagnosed, thus representing both under-diagnosis and under-treatment. Data are crude estimates; see appendix (pp 1–3) for results by age groups. In South Korea, and to a lesser degree in Iran, the age-specific associations of treatment coverage with education were a mix of direct, inverse, and no association.

Education was categorised into three or four groups in each country, from lowest to highest. Cambodia: no formal schooling 23.1%; less than primary school 41.0%; primary school completed 20.2%; secondary school or higher 15.7%. Colombia: no formal schooling or less than primary school 23.9%; primary school completed 39.0%; secondary school completed 30.1%; university completed 7.0%. Iran: no formal schooling 27.4%; primary and middle school 40.7%; secondary school 21.9%; undergraduate and graduate 10.0%. Malawi: no formal schooling 22.3%; less than primary school 34.4%; primary school completed 27.7%; secondary school or higher 15.6%. South Korea: middle school or less 24.3%; secondary school 39.3%; college or higher 36.4%. USA: below secondary 17.2%; secondary/General Educational Development or equivalent 23.2%; college or higher 59.6%. Data are from an analysis of five nationally representative health examination surveys (Cambodia: STEPS 2010; Colombia: Encuesta Nacional de Salud 2007; Iran: Non-Communicable Disease Surveillance Survey 2005; Malawi: STEPS 2009; South Korea: three rounds of National Health and Nutrition Examination Survey between 2008 and 2010; USA: three rounds of National Health and Nutrition Examination Survey between 2005 and 2010).

See Online for appendix

interventions is that most European women undergo regular cervical cancer screening, compared with less than 10% of women in some countries in south Asia and sub-Saharan Africa.³⁴ Similarly, analysis of nationally representative health examination surveys shows that two-thirds of people with diabetes and hypertension receive treatment in high-income countries such as South Korea and the USA, but coverage is less than 50% in low-income and middle-income countries, and lowest in sub-Saharan Africa (figure 2).

Low access to treatment leads to poor prognosis and survival in patients with NCDs in developing countries.

For example, patients with cancer in high-income countries have up to twice the survival rate of those in middle-income countries, and survival rates are even lower in India and Africa.^{35–37} The differentials are especially large for cancers that have good prognosis when diagnosed early, indicating that some treatment variation is caused by diagnosis inequalities.³⁷ However, even diagnosed patients in low-income and middle-income countries receive less treatment than do their counterparts in high-income countries. For example, most European patients with coronary heart disease receive antiplatelet treatment, β blockers, and drugs to

Panel: Non-communicable diseases in indigenous communities—inadequate response to large inequalities

In 2001, when male life expectancy in the USA was more than 74 years, Native American men in southwest South Dakota had a life expectancy of 58 years, which was about the same as that of men in Eritrea.²⁰ The excess mortality in Native Americans is partly attributable to higher mortality from road traffic accidents and other unintentional and intentional injuries, and partly to higher-than-average mortality from cardiovascular diseases, diabetes, liver disease, and a few other non-communicable diseases (NCDs). Native Americans who live on or near reservations also have some of highest mean body-mass index values, blood glucose concentrations, and prevalence of smoking and harmful alcohol use of all Americans.^{41,42} These trends exemplify the health and NCD status of indigenous populations in countries such as Australia, Canada, New Zealand, and the USA; in these countries, as in middle-income countries such as Mexico, the life expectancy of indigenous people is up to 20 years lower than that of non-indigenous populations.^{43,44}

Health inequalities are inevitably affected by the fact that indigenous people are overwhelmingly poorer and receive less education than do non-indigenous populations.⁴⁵ However, the health status seems to be worse even compared with non-indigenous groups with low socioeconomic status in the same country. For example, in the USA, the life expectancy of Native Americans living on or near reservations was about 2.5 years lower than poor white people in Appalachia, who also had low life expectancy. Elimination or reduction of these inequalities needs actions and policies in the social, economic, and health sectors.

New Zealand and Canada have different approaches to management of NCDs and their risk factors in their indigenous populations. In New Zealand, the neoliberal reforms of the 1980s and early 1990s led to a larger increase in unemployment and poverty in Māori than in European populations, reduced health services, created a regressive consumption tax, and affected other social services including income and housing support and the introduction of user fees for other services.²¹ The health gap between Māori and non-Māori populations increased soon afterwards, with a rise in the contribution of cardiovascular disease and suicides to the overall mortality gap.²¹ The economic and social policies began to change in the mid-1990s, and became more pro-equity in 1999. Importantly, reduction of health inequalities and improvement of primary care became explicit goals of the government's health policy, strengthened by high-quality evidence of their extent and trends.²¹ Challenges that remain include establishment of the most appropriate and effective strategies to reduce inequalities in risk factors such as smoking and to ensure that care is sought and delivered. Nonetheless, the more pro-equity policies and programmes seem to have helped to reduce health inequalities compared with their peak in the 1990s.

By contrast with New Zealand's efforts to reduce health inequalities, recent policy choices could worsen health inequalities between Canada's indigenous population (the First Nations) and other groups. The Conservative Government's economic policies have reduced and changed social and health services in ways that have especially adverse effects on the formulation and implementation of programmes related to First Nations' health and nutrition. Some of these changes are broad and restrict First Nations' rights to land and to economic, legal, and health decision making, while taking advantage of petroleum and mineral natural resources on their land.⁴⁶ Other changes with potential adverse effects are related to specific programmes, such as the replacement of the Food Mail Programme, which increased access to healthier foods in communities in northern Canada.⁴⁷ Qualitative assessments of the new Nutrition North Canada programme have raised concerns about lack of transparency in eligibility criteria⁴⁶ and about whether the subsidies are passed on to people.⁴⁸ Funding cuts to the First Nations Statistical Institute⁴⁶ might exacerbate the situation further by making the data needed for reporting and accountability related to health inequalities difficult to obtain; data for monitoring health inequalities over time in New Zealand have been an important accountability mechanism.

lower blood pressure and lipids,³⁸ whereas, with the possible exception of antiplatelet treatment, coverage is systematically lower in low-income and middle-income countries, and is as low as 5% for statins.^{39,40}

Within-country inequalities

NCD outcomes

Studies in high-income countries, especially those outside Asia, have shown that NCD mortality is higher in people with low education, income, or social class;^{8–17} those in marginalised ethnic groups (panel);^{18–21} and those living in poor and deprived communities.^{22–25} These socioeconomic gradients are generally smaller, and for some diseases even reversed, in southern Europe and Asia.^{9,10,49,50}

Figure 3 shows age-standardised cancer and cardiovascular disease death rates in the lowest and highest quintiles of community socioeconomic status in England, Japan, New Zealand, and South Korea—four countries with complete death registration and medical certification of cause of death. In England and New Zealand, cancer and cardiovascular disease death rates of young and middle-aged adults (30–64 years of age) living in the most disadvantaged communities were 50–120 per 100 000 higher than were those in the communities with the highest socioeconomic status (figure 3). The absolute inequalities for these two diseases were less than 15 per 100 000 in Japan and less than 30 per 100 000 people in South Korea. At older ages, NCD mortality inequalities are even more distinct across countries. England and New Zealand had large absolute and relative inequalities in people older than 65 years, similar to the experience of those younger than 65 years. Inequalities in older ages were also evident in Japan, but had a smaller relative magnitude than was noted in Japanese people younger than 65 years. However, in South Korea, the mortality differential was very small at older ages, with a weak inverse relation for cardiovascular disease mortality. The different inequality patterns at older ages in South Korea, where there has been a rapid recent decline in adult mortality, could be due to cohort patterns of smoking, obesity, and dietary factors. For cardiovascular disease, the inequality might also be affected by assignment of cause of death, because more deaths are assigned to senility in communities of low socioeconomic status than in communities of high socioeconomic status; these deaths are probably mostly due to cardiovascular disease.⁵¹ Patterns by sex were similar to those for both sexes combined, although death rates and absolute inequalities were generally larger for men than for women.

With the exception of South Korea, cancers, cardiovascular diseases, chronic respiratory diseases, and diabetes accounted for 45–75% of absolute inequalities in total (all-cause) death rates between the lowest and highest quintiles in people aged 30–64 years (figure 4); their contribution to inequalities in total death rates was 60–85% in older age groups. In other studies (mostly in high-income countries), investigators have reported that

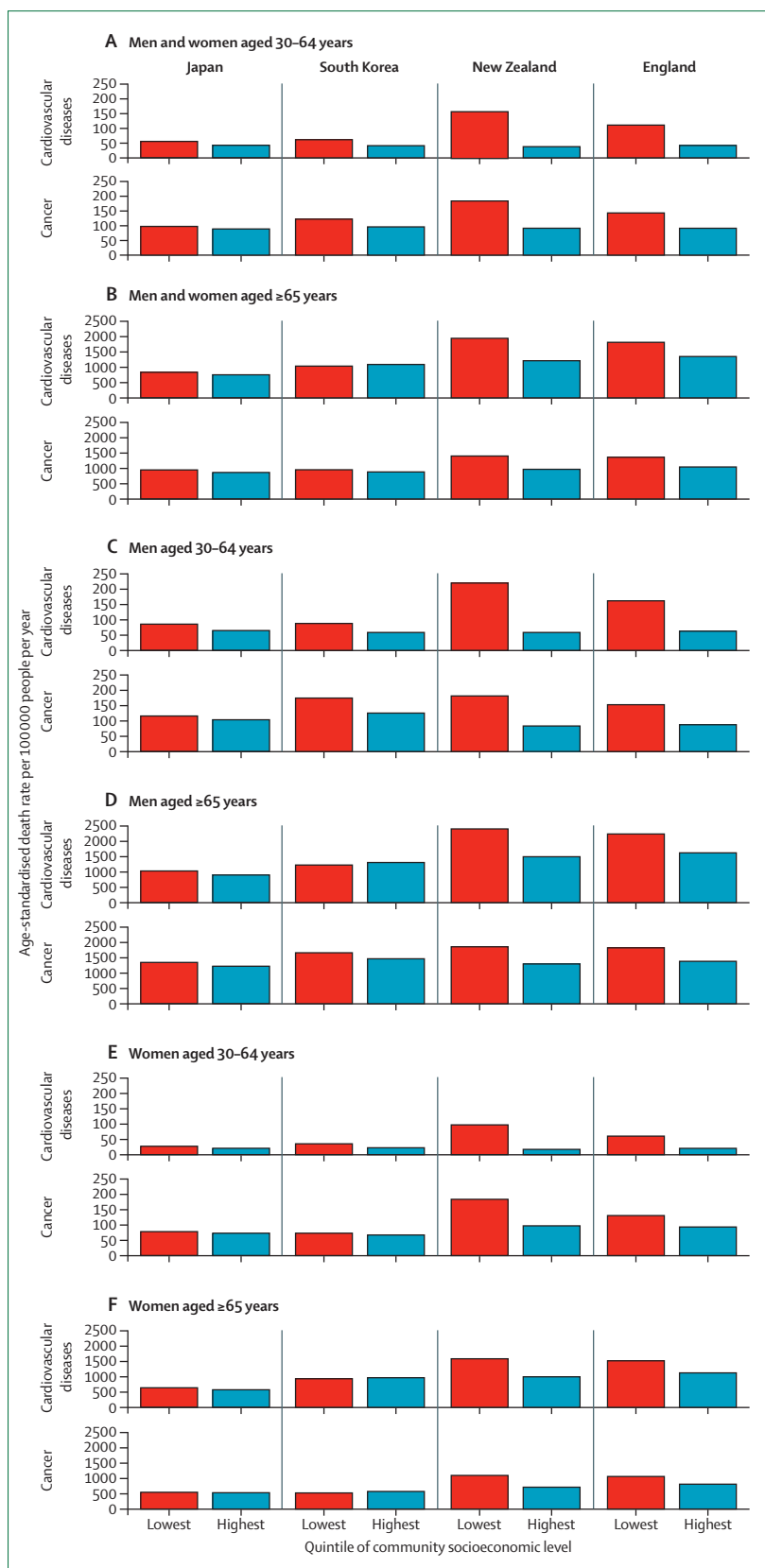
NCD inequalities are the most important source of inequalities in total mortality and life expectancy.^{12,18,20–22,52,53}

Figure 3 also shows the importance of health inequalities both between and within countries. First, the most disadvantaged communities in Japan had lower cardiovascular disease death rates in people older than 65 years than did the most advantaged communities in the other three countries. Second, if the whole population in each country had the same cardiovascular disease and cancer death rates as the most advantaged quintile in that same country (ie, if within-country inequalities were reduced), mortality from these causes would decrease by 3–33% in these two age groups and four countries. Third, if the whole population in each country had the same cardiovascular disease and cancer mortality as the most advantaged quintile in Japan (ie, if both within-country and between-country inequalities were reduced), mortality from these causes would decrease by 3–41% in these age groups and countries.

The differences in figure 3 between countries of similar wealth and economic development could be partly due to the different sizes of the units of analysis (appendix pp 4–10), since the largest differences are in England and New Zealand, which have smaller units of comparison than do Japan and South Korea. However, the data also show the importance of social, cultural, epidemiological, and health-care factors as determinants of health inequalities. For example, communities in South Korea and Japan might be less socioeconomically segregated, which could explain the more equitable mortality gradient across communities, although inequalities do exist in relation to individual socioeconomic characteristics in South Korea.^{50,54,55} In Japan, inequalities based on occupation are smaller, and for some NCDs are reversed, than in other high-income countries.^{49,56,57} Socioeconomic inequalities in New Zealand partly represent those associated with marginalisation of the indigenous Māori population, who have two-to-three-times higher NCD death rates than do non-Māori populations²¹ and are disproportionately represented in disadvantaged communities. However, even after ethnic origin is accounted for, socioeconomic inequality persists, the magnitude of which ranges between 63% (for cardiovascular disease in women aged 30–64 years) and 93% (for cardiovascular disease in men aged ≥65 years) of those shown in figure 3.

Figure 3: Age-standardised death rates per 100 000 people per year from cancers and cardiovascular diseases in the lowest and highest quintiles of community socioeconomic status in four countries with complete vital statistics and medical certification

(A) Data for men and women aged 30–64 years. (B) Data for men and women aged 65 years and older. (C) Data for men aged 30–64 years. (D) Data for men aged 65 years and older. (E) Data for women aged 30–64 years. (F) Data for women aged 65 years and older. See appendix (pp 4–10) for results for all socioeconomic status quintiles. In South Korea, death rates assigned to senility, which are likely to be mostly from cardiovascular diseases, as the underlying cause were 846 per 100 000 in the lowest quintile and 608 per 100 000 in the highest quintile.



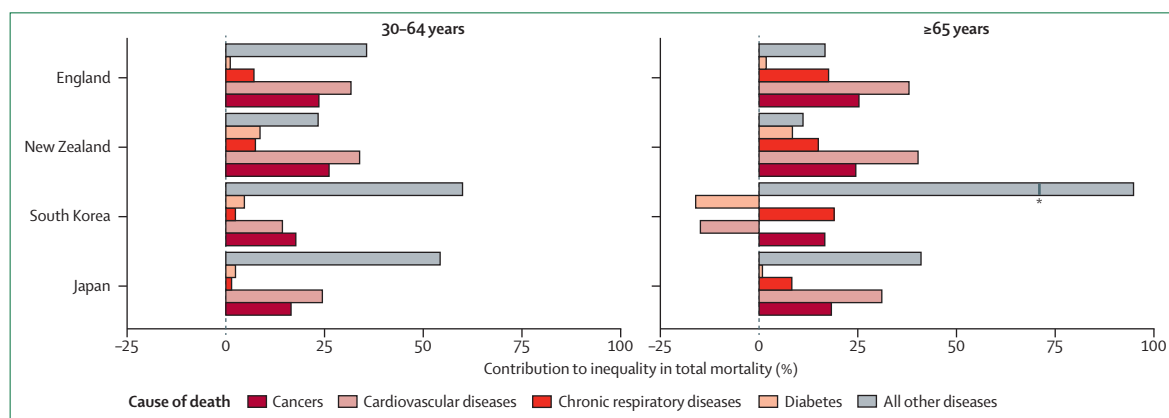


Figure 4: Contribution of selected non-communicable diseases to the absolute inequality in total (all-cause) death rates between the lowest and highest quintiles of community socioeconomic status in four countries with complete vital statistics and medical certification

*In South Korea, 72% of the excess death rate in the lowest quintile compared with the highest quintile is attributable to deaths assigned to senility as the underlying cause; these are likely to be mostly from cardiovascular diseases.

Data for NCD mortality inequalities are more scarce in low-income and middle-income countries, especially nationally, perhaps because the few existing data have focused on measurement of adult mortality nationally, rather than inequalities within countries, as has been done for child mortality.²⁶ In a national study in Mexico, poor regions had not only higher child mortality but also higher NCD burdens than did wealthier states.⁵⁸ Emerging evidence also indicates that acute myocardial infarction and stroke are inversely associated with education in eastern Europe, but this association could be direct in Africa.⁵⁹

NCD risk factors

The socioeconomic patterns of major NCD risk factors show similarities and important differences across countries on the basis of region and stage of economic development. Smoking was more prevalent in people with less education in countries at all levels of economic development; this association was more pronounced in men than women (figure 5).^{60,61} By contrast with smoking, concentration of serum total cholesterol and body-mass index had positive associations with education in low-income countries and, for men, in middle-income countries,⁶²⁻⁶⁴ whereas in high-income countries, both risk factors were inversely associated with education in women but neither risk factor had an association with education in men (figure 5). Systolic blood pressure, which is affected by diet (salt intake and intake of fresh fruits and vegetables), blood-pressure-lowering drug, and body-mass index, was inversely associated with education in middle-income and high-income countries, but had a weak positive association with education in men in low-income countries.

Investigators have studied how risk factor inequalities change over time in the same community or country.⁶⁵⁻⁷⁵ These changes have varied by risk factor and study. Nonetheless, with the exception of blood pressure for which inequalities decreased in some studies, socioeco-

nomic gradients in risk factors have persisted or even increased, irrespective of whether overall risk factors increased or decreased. The appendix (pp 11-15) shows data for risk factor inequalities over time in the USA and South Korea—two countries with repeated national health examination surveys. With few exceptions, systolic blood pressure had a persistent inverse association with education in both countries. The notable decrease in systolic blood pressure in both countries meant that in the late 2000s, despite continued inequality, people with the least education typically had lower systolic blood pressure than those with high education had experienced in the early surveys. In the USA, decreasing smoking prevalence and rising concentrations of fasting plasma glucose concentrations between 1980 and 2010 were both accompanied by increasing inequalities in these risk factors for both sexes, as reported for smoking in other studies.^{65,66,68,71} The increasing inequality was largely attributable to a faster decrease in smoking and a slower increase in concentration of fasting plasma glucose in more educated individuals.⁶⁵ In older Americans, there was little educational gradient in fasting plasma glucose and smoking in 1980, but by the late 2000s, people with less education had higher exposure to both risk factors. Educational inequality in smoking also increased in people younger than 65 years in South Korea, as overall prevalence decreased for men and increased for women. Body-mass index increased at all levels of education in the USA, and was accompanied by a narrowing of the differences between education groups; the same increase in body-mass index and lessening of inequality was detected for both men and women, with women having a substantially larger inverse educational gradient. In South Korea, the educational inequalities in body-mass index were greatest for women younger than 65 years and changed little over time.

Prospective cohort studies and national comparative risk assessments have shown that social inequalities in risk factors such as smoking, blood pressure, cholesterol,

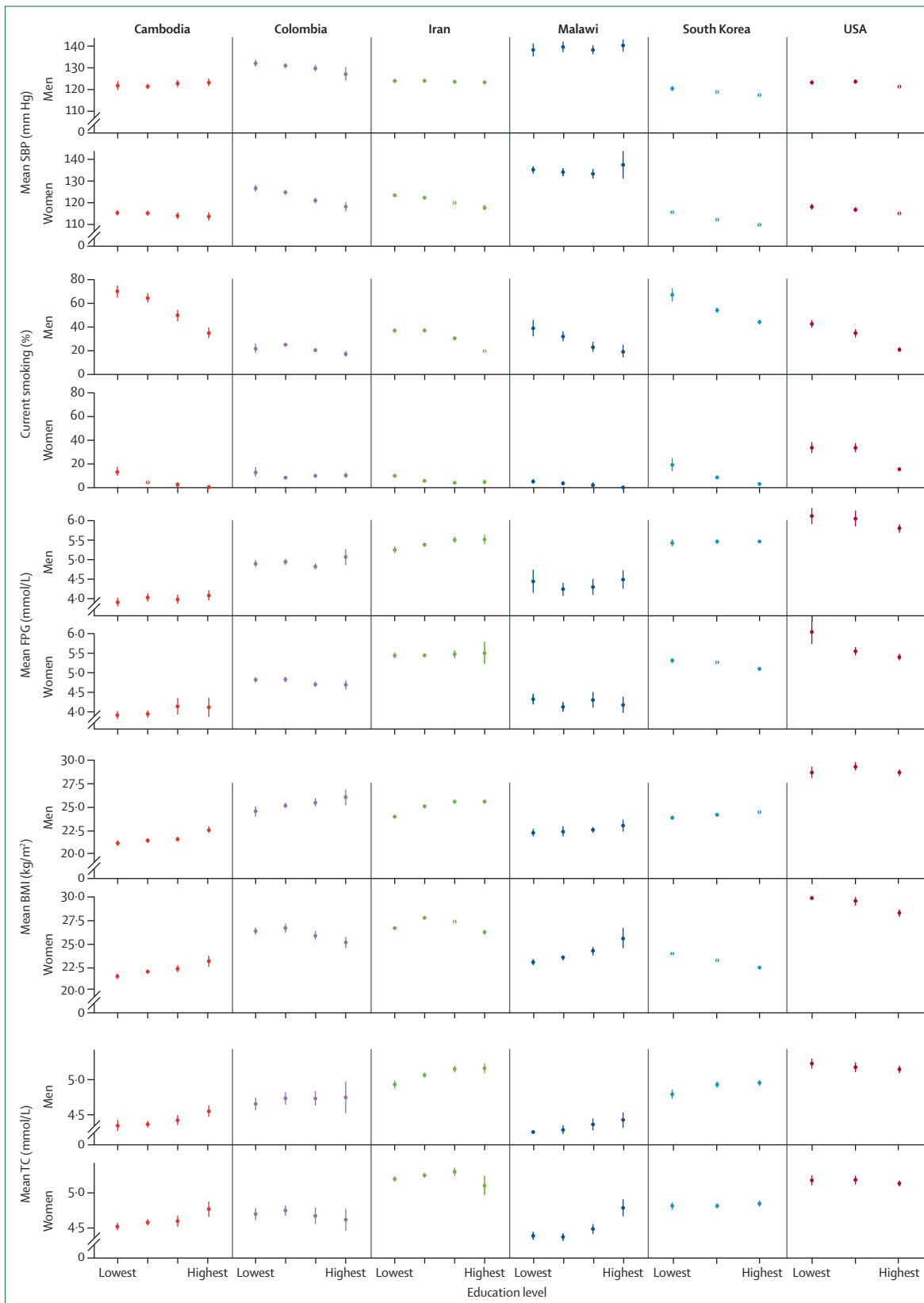


Figure 5: Selected non-communicable disease risk factors by education level in adults aged 25–64 years in selected countries
Risk factor levels were age standardised with the WHO standard population. All data are based on nationally representative health examination surveys listed in figure 2. See figure 2 for definitions of education levels in each country. SBP=systolic blood pressure. FPG=fasting plasma glucose. BMI=body-mass index. TC=total cholesterol.

glycaemia and diabetes, body-mass index, and alcohol use account for more than half of the absolute inequalities in important NCD outcomes, especially for cardiovascular disease and lung cancer.^{54,55,76–83} Thus, equitable reductions in risk factor exposure are essential to reduce social inequalities in NCD outcomes. However, in practice, irrespective of their aggregate success or failure in risk factor management, past prevention efforts have not generally reduced inequalities in risk factor exposure. Furthermore, disease prevention efforts should be assessed both on the basis of their aggregate benefits and in terms of their effect on social and geographical distributions of risk factors. To achieve this aim, accountability for NCD prevention should also incorporate within-country inequalities in risk factor exposure.⁶

NCD health care

Inequalities also exist in financial and physical access to health care, and health-care use and quality, based on individual and community characteristics. These factors lead to inequalities in NCD screening, diagnosis, and treatment. In the PURE study,³⁹ use of medication for secondary prevention after cardiovascular events was lower in patients in rural than in urban communities in low-income and lower-middle-income countries; this difference was smaller in upper-middle-income countries and absent in high-income countries. Screening for breast, cervical, colorectal, and prostate cancers increases with education and income.^{84,85} This association is consistent with the finding that socioeconomic gradients of survival are stronger for cancers with local symptoms that have a good prognosis if diagnosed and treated early than for cancers that present late and tend to have low survival (eg, lung and pancreatic cancers).^{86,87} Similar inequalities exist in glycaemic control and in microvascular and macrovascular complications of diabetes, on the basis of individual and community socioeconomic status.⁸⁸

Although some differences in survival might be due to the higher prevalence of comorbidities in socially disadvantaged patients, documented factors at the health system level also have a role; such system-based inequalities are both more obvious and amenable to intervention.^{89,90} Notably, improved financial access to care through universal insurance improves treatment coverage and helps to reduce its socioeconomic gradient. For example, in the USA, universal insurance at 65 years of age was associated with lower racial and educational differences in blood pressure, cholesterol, and diabetes control.⁹¹ Similarly, at any education level, screening for breast, cervical, and colorectal cancers was about twice as common in people with insurance as in those without, and those who were insured had better survival than did uninsured (or underinsured) patients.⁹² Health insurance and universal accessible primary care also improve glycaemic control and reduce symptoms and complications in patients with diabetes.^{88,93}

Figure 2 shows diabetes and hypertension treatment coverage according to education in several countries. Diabetes treatment coverage was positively associated with education only in Malawi and perhaps Cambodia (ie, the two low-income countries), and had a negative association in Iran, South Korea, and, for women, in Colombia. The inverse association in South Korea, and to a lesser degree in Iran, occurs because people with more education are generally younger, and younger people have lower treatment coverage; associations of treatment coverage with education within age groups were a mixture of direct, inverse, and no association (appendix pp 1–3). The inverse associations in Iran and Colombia are consistent with a role for universal insurance or other methods to remove financial barriers to health care to counteract treatment access inequalities. Coverage of hypertension treatment had no strong association with education, except in South Korea and in Iranian women, with similar explanations to those for diabetes treatment.

Although universal insurance reduces health-care inequalities, it does not remove them completely. In Finland, where everyone is insured, high-income patients with stroke were more likely than were their low-income counterparts to be treated at a university hospital by a neurology specialist and to have a CT or MRI scan.⁹⁴ There was also an inverse association between income and chronic heart disease case-fatality rates in Finnish patients.⁹⁵ Similarly, disparities in cancer screening and diabetes outcomes based on income and ethnic origin have been reported in insured patients in the USA.^{85,88} Health-care inequalities beyond financial access show the roles of other systemic factors, including lower density or quality of health-care facilities in poor communities, difficulties in arranging appointments for people who have little control over their work schedules, fundamental biases against poor and marginalised groups, and lower health-care use by some groups because health systems information and interactions are not designed for diverse users.

What can be done about NCD inequalities?

The available worldwide data show that NCD mortality and most NCD risk factors are higher in low-income and middle-income countries than in high-income countries. NCDs and some of their most important risk factors tend to be higher in people and communities with a lower socioeconomic status within the same country, but differences in within-country patterns depend on the stage of economic development, and especially on social, economic, and health policies. Social inequalities in risk factors account for more than half of inequalities in major NCDs, especially for cardiovascular diseases and lung cancer. NCDs account for most inequalities in total mortality both between and within countries. Therefore, NCD inequalities are a major barrier in the reduction of the total burden of these diseases and in achievement of good health for all people.

The focus of policy discussions about NCDs in preparation for, and after, the UN high-level meeting has been a reduction of the total magnitude of NCDs. If the goals and targets set in these discussions lead to actions at the country level, they will help to reduce the absolute gap across countries if a similar percentage reduction is achieved in each country—a similar percentage translates into a larger absolute reduction in countries with higher NCD burdens. Further reduction of global inequalities will need actions and targets that focus on countries where NCD mortality and risk factors are presently highest—ie, generally low-income and middle-income countries. However, worldwide discussions have paid little attention to within-country inequalities. Yet, a decrease in overall NCD rates will need reduction of inequalities because the health of the most disadvantaged people contributes substantially to the overall NCD burden. Thus, reduction of the total NCD burden and of NCD inequalities should be treated as related and mutually reinforcing priorities.

Past work into the causes of health inequalities has drawn attention to the roles of environmental, political, and psychosocial factors; health behaviours and proximal risk factors; and health-care access and quality. These factors are not mutually exclusive, since deprivation and poor working and living environments are themselves causes of hazardous health behaviours and low-quality health care. Actions to reduce NCDs and NCD inequalities should therefore rely on social and economic policies, and actions related to diet, lifestyle, and health care. Any one approach alone will be insufficient to reduce inequality, might not be implementable in isolation, and hence will need the other components to be effective.

The Commission on Social Determinants of Health's (CSDoH) recommendation of health equity in all policies, systems, and programmes aims to reduce NCD inequalities by equalising distributions of power, financial resources, education, housing, and other environmental factors, nutrition, and health care.^{96,97} As a timely step towards this aim, the policy recommendations and related targets and accountability mechanisms in the UN post-2015 development agenda should focus explicitly on how they can affect and address NCD and other health inequalities. The CSDoH recommended that fundamental social and economic inequalities and their institutional and political determinants should be addressed as one of the action principles to improve health and reduce inequalities. However, careful assessment of health inequalities in high-income countries indicates that welfare states, and their social policies, do not necessarily reduce health inequalities,⁹⁸ partly because existing policies only partially redistribute income and wealth. Meanwhile, increasing evidence supports important roles for non-material factors that have other social, cultural, behavioural, environmental, and public health and health system determinants in NCD inequalities.⁹⁸ Thus, health inequalities, which are sometimes large, can still exist even with progressive social policies, because of inequalities in

access and quality of primary care and treatment, or in risk factors related to diet, lifestyle, and living environment. For example, a country could have a seemingly pro-equity welfare state and organisation of social and health services, but simultaneously be at the stage of the tobacco epidemic in which large absolute differences in smoking prevalence between social groups cause wide health inequalities.⁹⁹ This finding shows the need for strong policies and programmes that focus more directly on NCD risk factors and treatment, in addition to those that address social determinants. If implemented well and with equity as an explicit consideration, such policies and programmes could reduce NCD inequalities rapidly.

Importantly, NCD inequalities could be as much a cause as a consequence of socioeconomic inequalities. In several countries, investigators have noted that so-called health shocks are associated with a worsening of household economic status through both reduced earnings and increased (at times catastrophic) health-care spending that can drive households into poverty. Increased health-care spending is exacerbated if health insurance coverage is low and out-of-pocket spending for health care is high. Emerging evidence suggests that NCDs not only lead to such worsening of household economic status, but also can have larger effects than communicable diseases.^{100,101} Thus, universal health insurance that ensures equitable NCD prevention and protects against NCD-attributable macroeconomic loss, income inequality, and poverty should be a social and economic priority.

Social policies and programmes that improve opportunities and capabilities for economic productivity and social participation, and facilitate healthy lifestyles and environments, are essential to improve health and reduce inequalities. The most important are those that enhance early childhood development, improve access to high-quality education, create home and school environments that facilitate good educational outcomes, and remove barriers to secure employment for disadvantaged groups.⁹⁷ On the premise that both progressive social policies and NCD prevention and treatment programmes are necessary to address NCD health inequalities, other key actions to reduce NCDs and NCD inequalities are described in the following paragraphs.

First, the nearly universal inequalities in tobacco smoking indicate the need for effective and equitable tobacco control. Similarly, global and within-country inequalities in blood pressure mean that actions are needed to reduce salt intake in disadvantaged groups to help to reduce NCD inequalities. Arguments are similar for harmful alcohol use and for other unhealthy versus healthy foods not covered in detail in this review. Population-wide and regulatory actions, such as mandatory salt, trans-fat, and sugar reductions in the food chain; taxes; and sales and advertising or marketing restrictions on tobacco, alcohol, or foods high in processed carbohydrates and saturated fats are probably pro-equity, although there have been few assessments of

the equity implications of these actions.^{61,102–107} Despite industry efforts to portray taxes on harmful and unhealthy products as regressive, evidence suggests that groups with low socioeconomic status are responsive to price changes, leading to both health benefits and to a reduction in the relative tax burden.^{108,109}

Similarly, government actions are essential to improve financial and physical access of disadvantaged social groups and communities to healthy foods, including fresh fruits and vegetables, healthy fats, and whole grains, through subsidies and broader food and agricultural policies. These actions can be financed by taxes on unhealthy foods, alcohol, and tobacco, but they need political and social support. Actions related to food have been implemented in some communities and countries (eg, New York City and some European countries¹¹⁰). A need exists to assess the effects of these programmes on inequalities and to test similar programmes in low-income and middle-income countries. Health education could widen inequalities, unless the messages and their delivery are well designed and explicitly aim to reach out to and affect disadvantaged and marginalised social groups—eg, through community groups or broad-reaching mass media.^{107,111}

Second, inequalities in cardiometabolic risk factors, in infections that are risk factors or precursors for cardiovascular disease and cancers, and in diagnosis of early disease stages, emphasise the need to strengthen and use primary care for equitable prevention and treatment.³¹ A successful primary care programme in the control and management of diabetes in Iran⁹³ is an example of the feasibility of universal, financially and physically accessible, and high-quality primary care as an effective way to reduce NCD burden and inequalities. To address NCDs through primary care, health workers need to be trained on screening and diagnosis of disorders that can have few symptoms in the early stages and, by contrast with some acute childhood and maternal diseases, involve longer term follow-up of diagnosed patients with disorders such as diabetes to improve compliance with medicines and behavioural change.⁹³ Previous reports have examined the implementation of primary care, including the health system infrastructure and human resources.¹¹² The report about health system integration in this Series discusses in detail the integration of NCD management in the primary care system in different health systems.³³ Targeting of NCDs through the primary care system needs high-quality, essential, and typically low-cost, drugs for prevention and early-stage treatment—including human papillomavirus and hepatitis B vaccines, Papanicolaou smear test or visual inspection with acetic acid for cervical cancer screening, drugs for cardiovascular risks and diabetes, and pain medications for terminally ill patients with cancer. Furthermore, there should be guaranteed access to such drugs, irrespective of the patient's ability to pay, in order to reduce NCD inequalities. Issues related to drug selection, regulation of their quality, and their pricing

are discussed in the report about essential medicines for NCDs in this Series.³² Essential medicines for NCDs are financially feasible through procurement of generic drugs rather than branded versions.

Third, beyond primary care, universal health insurance and other mechanisms for removal of financial barriers to health care are an essential component of any credible effort to reduce NCDs and NCD inequalities.¹¹³ A recent study,¹¹⁴ reviewed economic and political aspects of universal coverage, with emphasis on low-income and middle-income countries. Financial access needs to be accompanied by policies and strategies that reduce physical and behavioural barriers to health-care use and improve quality of care in disadvantaged communities.

Fourth, coordination is needed with programmes and policies that target poverty-related risk factors that adversely affect early childhood development and communicable diseases. Even though such coordination can lead to large and long-term improvements in NCDs and risk factors that benefit poor and disadvantaged groups, it is difficult because it needs involvement of multiple sectors, including those that develop and implement policies and strategies related to energy, agriculture and rural development, and education. Health interventions can also be coordinated (or integrated) in specific programmes as platforms of intervention delivery; the report on health system integration in this Series describes in detail some of the potential challenges of integration.³³

Finally, these actions should be accompanied by an accountability mechanism that records and regularly reports inequalities in NCDs and their risk factors alongside their aggregate benefits.⁶ Reporting of NCDs, and their risk factors and treatment, should be related to individual or community characteristics—both those that are somewhat comparable across countries (eg, rural or urban place of residence and education) and those that are country specific, such as geographical region and ethnic origin. How can this requirement be met in view of the fact that even national measurement of disease-specific mortality and risk factors is a challenge because of poor data availability, quality, and comparability? Data needs and challenges for aggregate (national) measurement also apply in measurement of inequalities.¹¹⁵ As an initial, relatively low-cost step, every data platform should collect information about place of residence and socioeconomic variables. In high-income and even middle-income countries, data can be linked across multiple sources that incorporate information about socioeconomic status and place of residence, but implementation of safeguards is necessary to ensure confidentiality and to overcome political and especially bureaucratic barriers. Even when such data are collected, data quality and comparability issues will need to be addressed, as has been done for the measurement of health outcomes and risk factors. However, in view of the importance of such data for pro-equity policies and programmes, and for assessment and modification of existing strategies, they should be treated

as essential components of a health information system. The inclusion of such variables in health statistics will also increase sensitivity towards inequalities, even if data are initially incomplete.

As the debate about why inequalities arise and whether they are unjust continues, we should constantly recall that the existence, and persistence, of inequalities suggests failure to develop, enact, or implement policies and programmes that create healthy household and community environments, facilitate healthy lifestyles and diets, and deliver universal high-quality health care. Health inequalities can be reduced by feasible actions that bring aggregate benefits and reduce the overall NCD burden. Many of these actions involve health care and public health, whereas others need participation of sectors that address broader social, economic, and environmental issues. We should measure the success and failure of our societies and governments by how quickly, how widely, and how well we take these actions, and how much they reduce health inequalities.

Contributors

MDC, Y-HK, PA, TB, MJC, FF, RG, NI, CK, KPM, and SO collected and analysed data. MDC, Y-HK, PA, TB, CK, JWL, MGM, and ME helped to identify relevant studies. ME oversaw the research and wrote the first draft of the report. MDC, Y-HK, PA, TB, CK, and JWL helped to write specific sections of the article. All authors provided input into the final report.

Conflicts of interest

ME chaired a session and gave a talk at the World Cardiology Congress (WCC), with travel cost reimbursed by the World Heart Federation. At the WCC, he also gave a talk at a session organised by PepsiCo with no financial remuneration.

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