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NCD Countdown 2030: pathways to achieving Sustainable Development Goal target 3.4



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The Sustainable Development Goal (SDG) target 3.4 is to reduce premature mortality from non-communicable diseases (NCDs) by a third by 2030 relative to 2015 levels, and to promote mental health and wellbeing. We used data on cause-specific mortality to characterise the risk and trends in NCD mortality in each country and evaluate combinations of reductions in NCD causes of death that can achieve SDG target 3.4. Among NCDs, ischaemic heart disease is responsible for the highest risk of premature death in more than half of all countries for women, and more than three-quarters for men. However, stroke, other cardiovascular diseases, and some cancers are associated with a similar risk, and in many countries, a higher risk of premature death than ischaemic heart disease. Although premature mortality from NCDs is declining in most countries, for most the pace of change is too slow to achieve SDG target 3.4. To investigate the options available to each country for achieving SDG target 3.4, we considered different scenarios, each representing a combination of fast (annual rate achieved by the tenth best performing percentile of all countries) and average (median of all countries) declines in risk of premature death from NCDs. Pathways analysis shows that every country has options for achieving SDG target 3.4. No country could achieve the target by addressing a single disease. In at least half the countries, achieving the target requires improvements in the rate of decline in at least five causes for women and in at least seven causes for men to the same rate achieved by the tenth best performing percentile of all countries. Tobacco and alcohol control and effective health-system interventions—including hypertension and diabetes treatment; primary and secondary cardiovascular disease prevention in high-risk individuals; low-dose inhaled corticosteroids and bronchodilators for asthma and chronic obstructive pulmonary disease; treatment of acute cardiovascular diseases, diabetes complications, and exacerbations of asthma and chronic obstructive pulmonary disease; and effective cancer screening and treatment—will reduce NCD causes of death necessary to achieve SDG target 3.4 in most countries.

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Introduction

Non-communicable diseases (NCDs) are the leading cause of death and ill health and account for seven of ten deaths worldwide.^{1–3} NCDs are included in the Sustainable Development Goals (SDGs) with the following target: “by 2030 reduce by one third [relative to 2015 levels] premature mortality from NCDs through prevention and treatment and promote mental health and well-being” (SDG target 3.4).⁴

NCD Countdown 2030 is an independent collaboration to inform policies, track progress, and enhance accountability towards reducing the burden of NCDs. The first paper from NCD Countdown 2030 showed that low-income and middle-income countries, especially in sub-Saharan Africa, and, for men, in central Asia and eastern Europe, had the highest risks of dying from NCDs.³ The paper also showed that progress is too slow to achieve the target in most countries. The results informed discussions at the third High-Level Meeting on NCDs at the UN General Assembly in 2018, but led to questions about how to accelerate progress in reducing

NCDs. This Health Policy paper focuses on identifying those pathways through which each country can achieve SDG target 3.4 to support governments and donors in prioritising resources and interventions in their national NCD response.

Although SDG target 3.4 specifies an overall reduction in NCD mortality by a third, there are differences across countries in the risk of dying from different NCDs.⁵ This diversity suggests that countries might need to take different routes towards achieving SDG target 3.4 by addressing different combinations of diseases. To identify country-specific options, in this Health Policy paper, we evaluate combinations of feasible reductions in specific NCDs, based on real experiences of some countries, that can achieve SDG target 3.4 in each country.

Global patterns of NCD4 mortality

The indicator used to measure progress towards SDG target 3.4 is the cumulative probability of dying from four NCDs (cancers, cardiovascular diseases, chronic

Key messages

- Achieving Sustainable Development Goal (SDG) target 3.4—to reduce premature mortality from non-communicable diseases (NCDs) by a third by 2030 relative to 2015 levels—is ambitious but every country has one or more pathways to achieve the target by 2030.
- Globally, regionally, and nationally the risk of dying from various NCDs is marked by huge diversity in terms of magnitude and changes over time. No country could achieve the SDG target 3.4 by addressing a single disease. Pathways to SDG target 3.4 require accelerating reductions in several NCDs to the rates of decline achieved in the best performing 10% of all countries.
- Country-specific decisions on which interventions and actions can accelerate progress towards the target are required. Essential components of strategies to achieve SDG target 3.4 in most countries include tobacco and alcohol control and effective health-system interventions. Scaling up these interventions requires an accessible and equitable health system, with a capacity for priority setting, and implementation of NCD care within the health system.

respiratory diseases, and diabetes; referred to as NCD4 hereafter) between exactly 30 years and exactly 70 years of age. The probability of death is calculated in the absence of competing causes of death (ie, causes other than NCD4) so that only the risk of dying from these NCDs is measured. For the pathways analysis, we used data from the 2016 WHO Global Health Estimates on age, sex, and cause-specific mortality for 176 countries and territories with a population of 200 000 or more in 2016. The data sources and methods for the WHO Global Health Estimates are described in detail elsewhere,¹ and are summarised in the appendix (pp 3–7).

See Online for appendix

Appendix figure 1 (pp 13–15) maps the probability of dying from NCD4 between 30 years and 70 years of age in 2015, which is the base year for measuring progress towards SDGs. Globally, the lowest risk of NCD4 mortality was seen in high-income countries in Asia-Pacific, western Europe, Australasia, and Canada. The highest risk of dying from NCD4 was observed in low-income and middle-income countries, especially in sub-Saharan Africa, and, for men, in central Asia and eastern Europe.

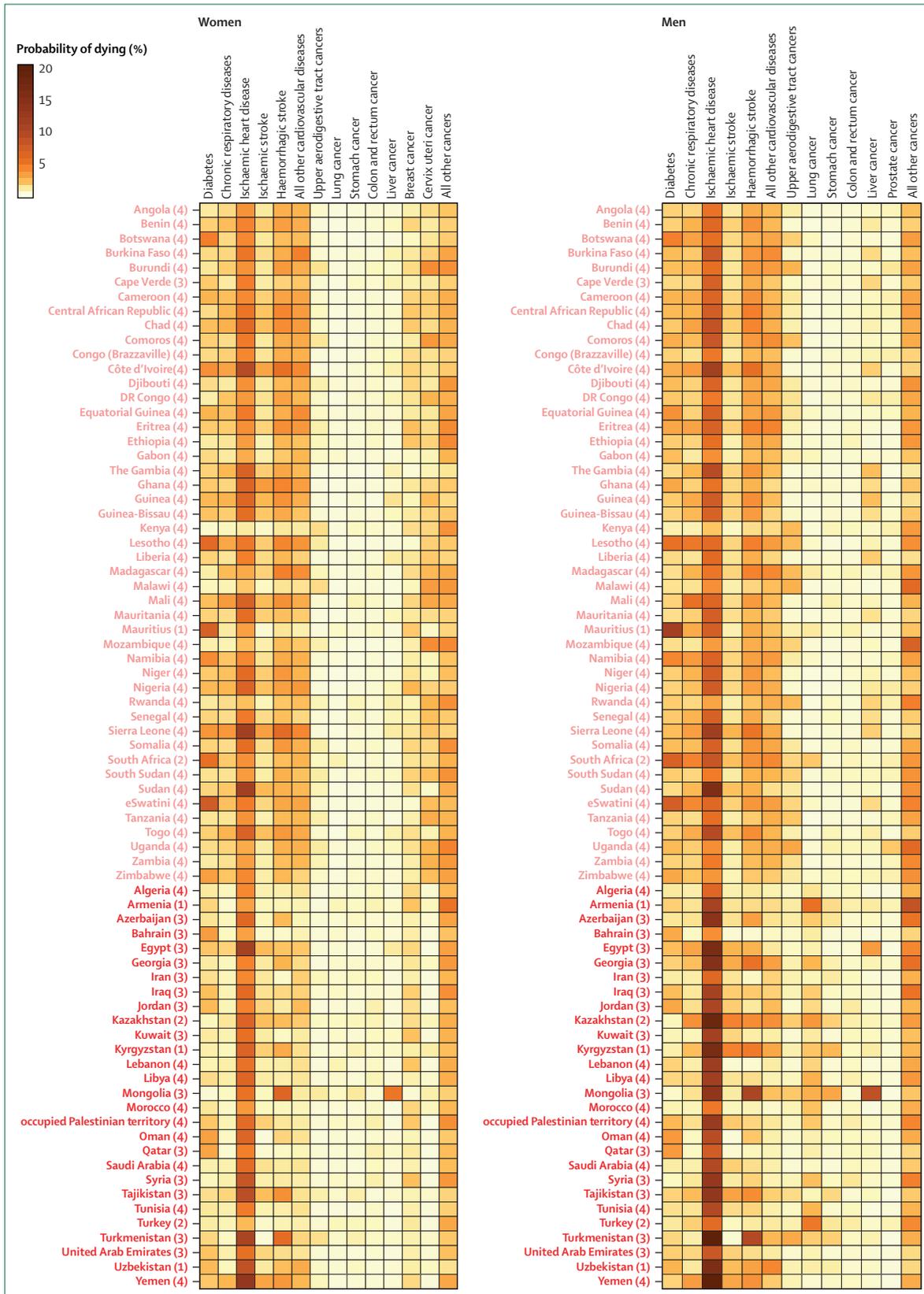
For women, the probability of dying from NCD4 between 30 years and 70 years of age was less than 6% in South Korea and Japan; it was also low in some high-income countries in western Europe (eg, Spain and Switzerland), Singapore, and Australia. The highest probabilities for women were seen in parts of sub-Saharan Africa (eg, Sierra Leone and Côte d'Ivoire), and in Guyana, Yemen, Afghanistan, and Papua New Guinea, where 30-year-old women had a one-in-four to one-in-three risk of dying from NCD4 before reaching their 70th birthday—about three-times to seven-times more likely than in low-mortality, high-income countries.

For men, the probability of dying from NCD4 was highest in central Asia (eg, Mongolia and Kazakhstan), eastern Europe (eg, Russia and Belarus), parts of Oceania (eg, Fiji and Papua New Guinea), North Korea, and

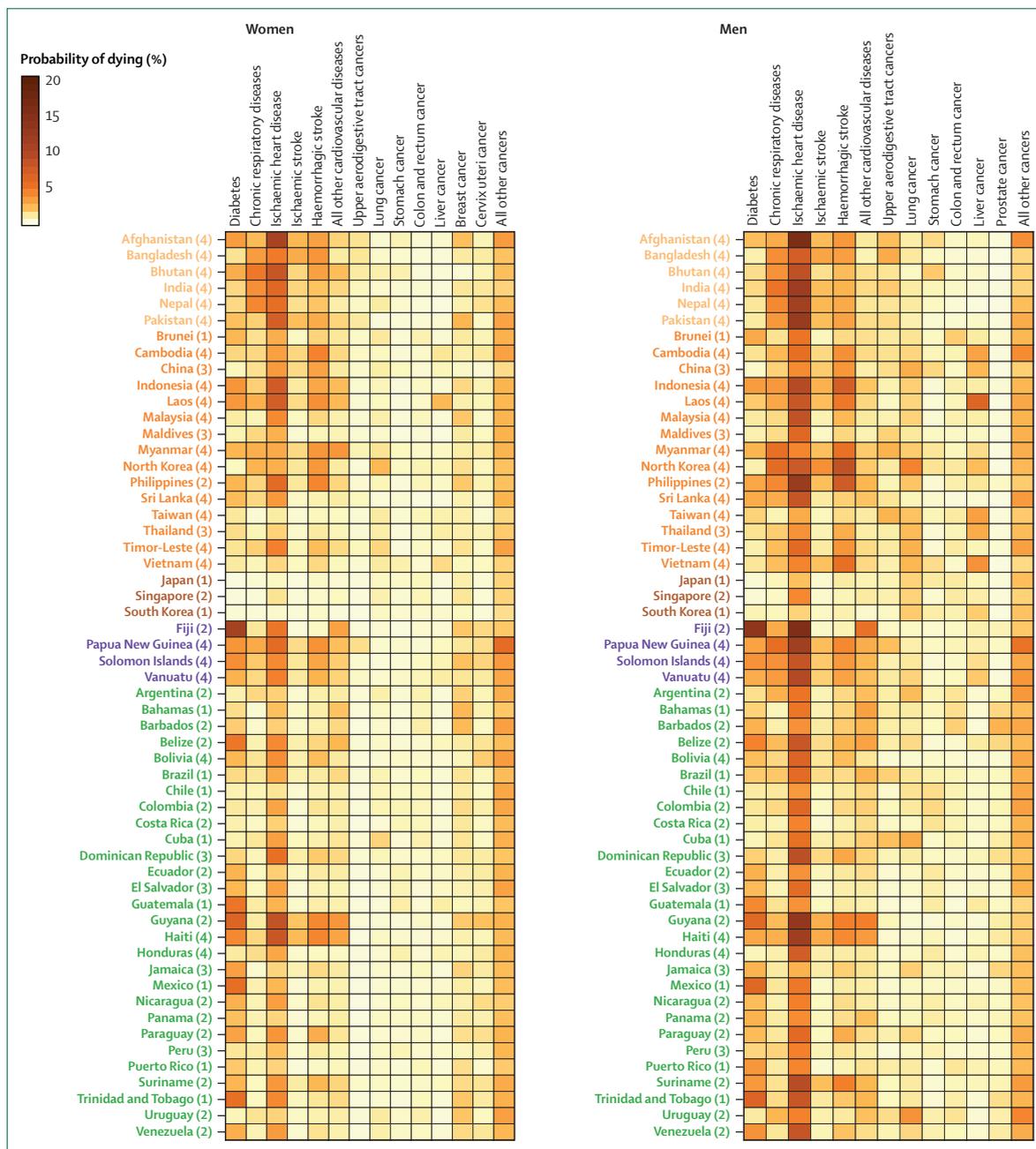
Yemen, with 30-year old men having a more than one-in-three risk of dying from an NCD4 before their 70th birthday. The lowest probabilities, ranging from 10% to 12%, were those in some high-income countries in western Europe (eg, Iceland and Switzerland), Bahrain, South Korea, Australia, Japan, Canada, New Zealand, and Singapore.

Individual or clusters of causes of death (referred to as causes of death hereafter) for analysing reduction pathways in NCD mortality were selected if they were one of ten leading causes of death in either women or men, and for either NCD4 between 30 years and 70 years of age, or for all NCDs plus suicide between birth and 80 years of age. The ranking of causes of death was based on the average across countries of the probability of dying from each cause of death. This process led to the selection of the following 15 causes of death for NCD4: diabetes, chronic respiratory diseases, ischaemic heart disease, ischaemic stroke, haemorrhagic stroke, other cardiovascular diseases, upper aerodigestive tract cancers, lung cancer, stomach cancer, colorectal cancer, liver cancer, breast cancer, cervix uteri cancer, prostate cancer, and other cancers. Two causes (breast and cervical cancer) were only applicable to women and one (prostate cancer) only to men. Additional causes of death for the analysis of all NCDs plus suicide were: liver cirrhosis; kidney and other genitourinary diseases; neurological conditions; mental and substance-use disorders and suicide (SDG target 3.4 uses deaths from suicide as a tracer condition for mental health); and other NCDs. Other NCDs include endocrine, blood, and immune disorders; digestive and genitourinary diseases (except those listed separately); congenital anomalies; and sense organ, skin, musculoskeletal, and oral and dental conditions.

Figure 1 shows the probability of dying between 30 years and 70 years of age from NCD4 causes of death in 2015 for 176 countries. Ischaemic heart disease was the leading NCD4 cause of death in people aged between 30 and 70 years in 146 (83.0%) countries for men and 98 (55.7%) for women. The highest risk of a 30-year-old dying from ischaemic heart disease before their 70th birthday was seen in eastern Europe, central Asia, the Middle East and north Africa, and south Asia. For men, the risk reached as high as 20% and for women as high as 13% in some countries. Other causes that occupied the leading position in at least one country and sex were diabetes (14 [8.0%] countries for women and four [2.3%] for men); haemorrhagic stroke (four [2.3%] countries for women and two [1.1%] for men); lung cancer (two [1.1%] countries for men); breast cancer and cervix uteri cancer (one [0.6%] country each for women); chronic respiratory diseases and liver cancer (one [0.6%] country each for men); and the residual groups of other cardiovascular diseases (one [0.6%] country for women) and other cancers



(Figure 1 continues on next page)



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(57 [32.4%] countries for women and 20 [11.4%] for men).

The risk of dying between 30 years and 70 years of age from NCD4 causes of death was greater for men than for women in most countries, except for diabetes (appendix pp 16–17). Additionally, women had a higher probability of dying from ischaemic stroke and the aggregate group of other cardiovascular diseases than men in many countries in sub-Saharan Africa, central Asia, the Middle East and north Africa.

Pace of change in NCD4

Based on 2010–16 trends, women in 17 of 176 (9.7%) countries and men in 15 of 176 (8.5%) countries are expected to achieve SDG target 3.4, a third reduction relative to 2015 levels in the probability of dying from NCD4 between 30 years and 70 years of age (appendix pp 18–20). Among high-income countries, men and women in Denmark, Luxembourg, New Zealand, Norway, Singapore, and South Korea are on track to meet the target if these countries maintain or surpass their

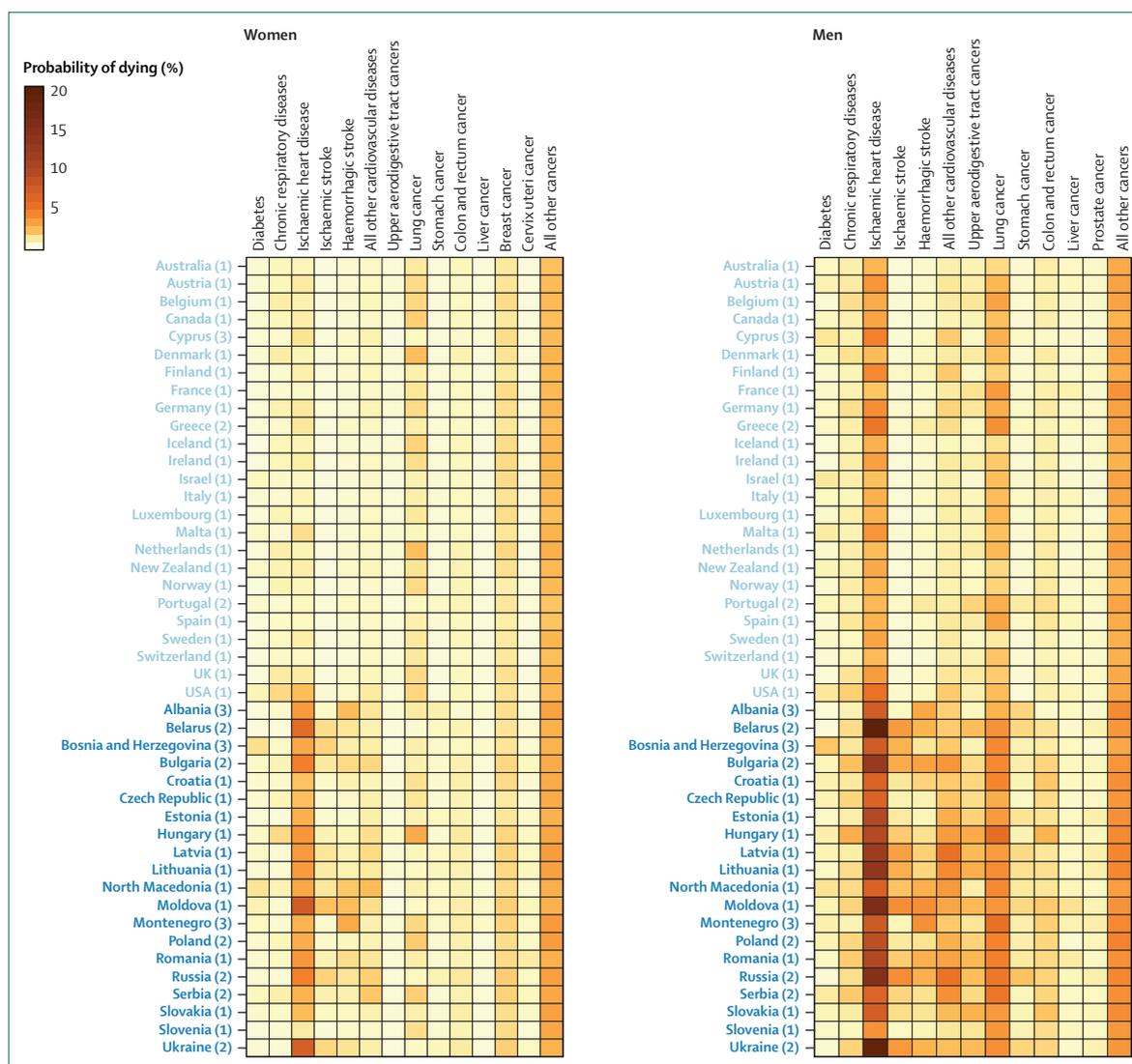


Figure 1: Probability of dying (reported as a percentage) in 2015 between 30 years and 70 years of age from NCD4 causes, by country

The colour of text for each country indicates a region (for a list of countries in each region see appendix p 43). The number in parentheses following each country's name indicates the quality of its vital registration system: 1=high, 2=medium, 3=low, and 4=very low.^{2,3} See appendix pp 29–30 for results on all non-communicable diseases plus suicide between birth and 80 years of age. NCD4=four non-communicable diseases including cancers, cardiovascular diseases, chronic respiratory diseases, and diabetes.

2010–16 average rate of decline; men in Finland and Iceland are also on track. The risk of dying prematurely from NCD4 is also declining rapidly in central and eastern Europe, from very high risk in men, with some countries in this region on track to achieve a third reduction by 2030 (men and women in Belarus; men in Czech Republic and Slovakia; women in Bosnia and Herzegovina, Latvia, Russia, Serbia, and Ukraine). NCD4 mortality among men and women in Iran, Kazakhstan, and the Maldives is declining fast enough to achieve the target of a third reduction by 2030. Women in Kuwait and Timor-Leste and men in Bahrain are also on track. A further eight (4·5%) countries for women and six (3·4%) for men, mostly in central and eastern Europe, are

expected to narrowly miss the target of a third reduction. If trends from 2010–16 continue, women and men in China and India, the two largest countries in the world, will have 4–15% reductions in the risk of premature death from NCD4 by 2030, which is not sufficient to meet SDG target 3.4.

At the other extreme, the probability of dying from NCD4 between 30 years and 70 years of age has stagnated or increased from 2010 to 2016 among women in 14 (8·0%) countries and men in 20 (11·4%) countries. These countries were in different regions, with the largest number in Africa. Large countries (with sex-specific populations of 10 million or more in 2015) that showed stagnation or small increases in mortality were Bangladesh

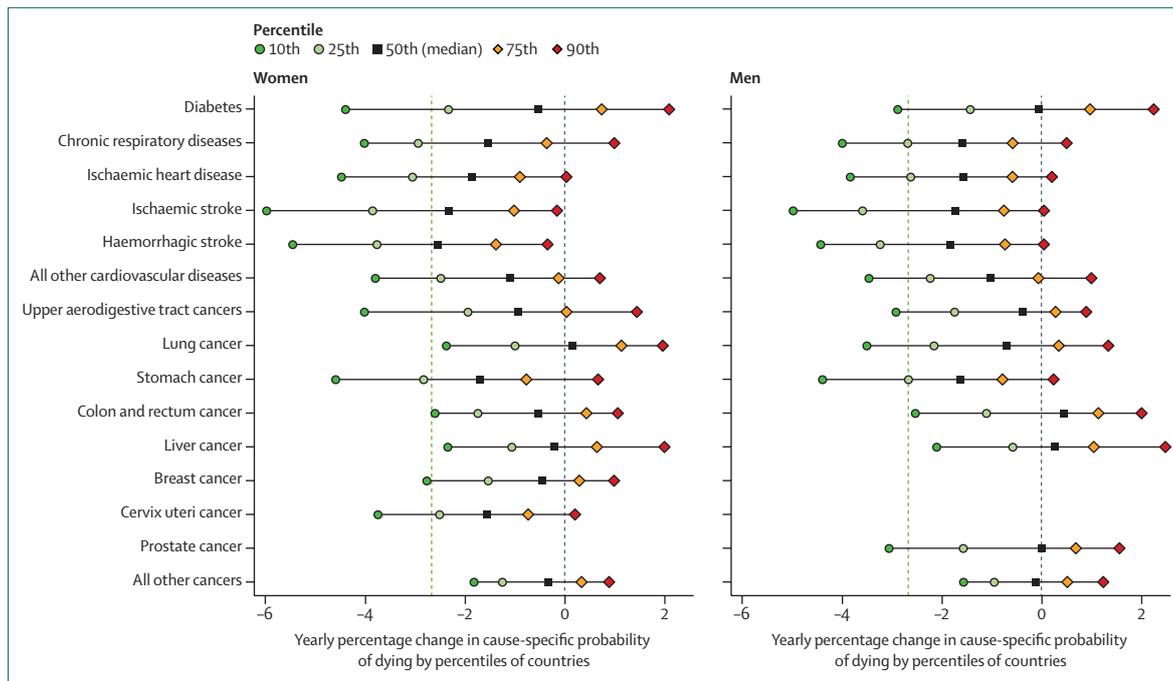


Figure 2: Distribution (percentiles of countries) of yearly percentage change from 2010 to 2016 in probability of dying between 30 years and 70 years of age from NCD4 causes of death

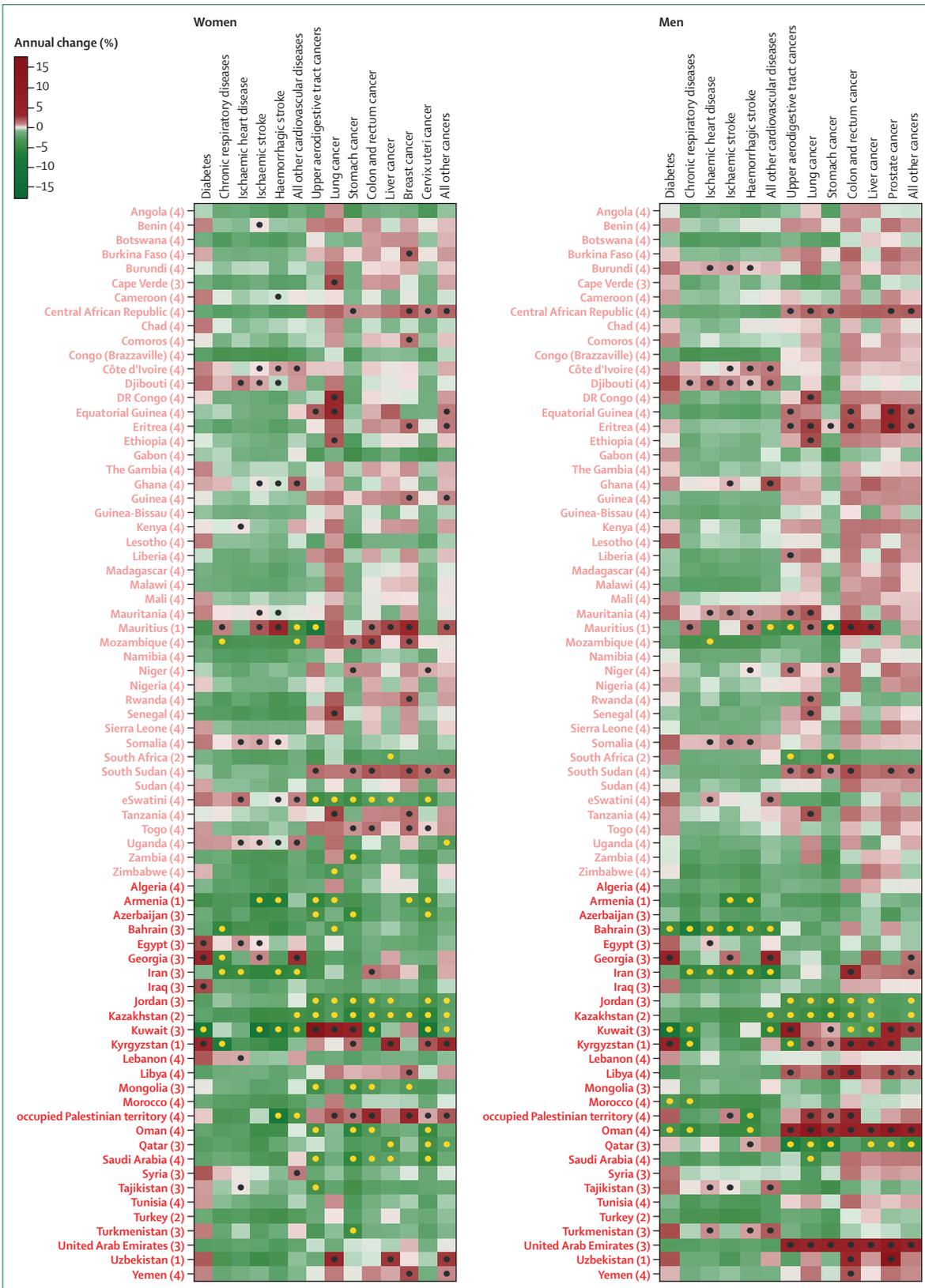
The tenth percentile indicates the rate of change that the top 10% of countries (18) are declining faster than, the 50th percentile is the median rate of change, and the 90th percentile shows the rate of change which 10% (18) of countries are slower than. See appendix pp 36–37 for results on all non-communicable diseases plus suicide between birth and 80 years of age. The green dashed vertical line shows the average rate of decline (2.67% per year; appendix pp 8–9) needed to achieve a third reduction in the probability of death from each cause by 2030 compared with 2015 levels. NCD4=four non-communicable diseases including cancers, cardiovascular diseases, chronic respiratory diseases, and diabetes.

(men), Egypt (women), Ghana (men and women), Côte d'Ivoire (men and women), Kenya (men and women), Mexico (men), Sri Lanka (women), Tanzania (men), and the USA (women). Even when the probability of dying from NCDs decreases, the number of deaths from NCDs might continue to increase because of changes in population size and age structure. For example, from 2010 to 2016, the number of deaths from NCD4 in those aged between 30 and 70 years increased from 11.2 million to 12.6 million globally, even though the probability of dying in this age range declined in most countries.

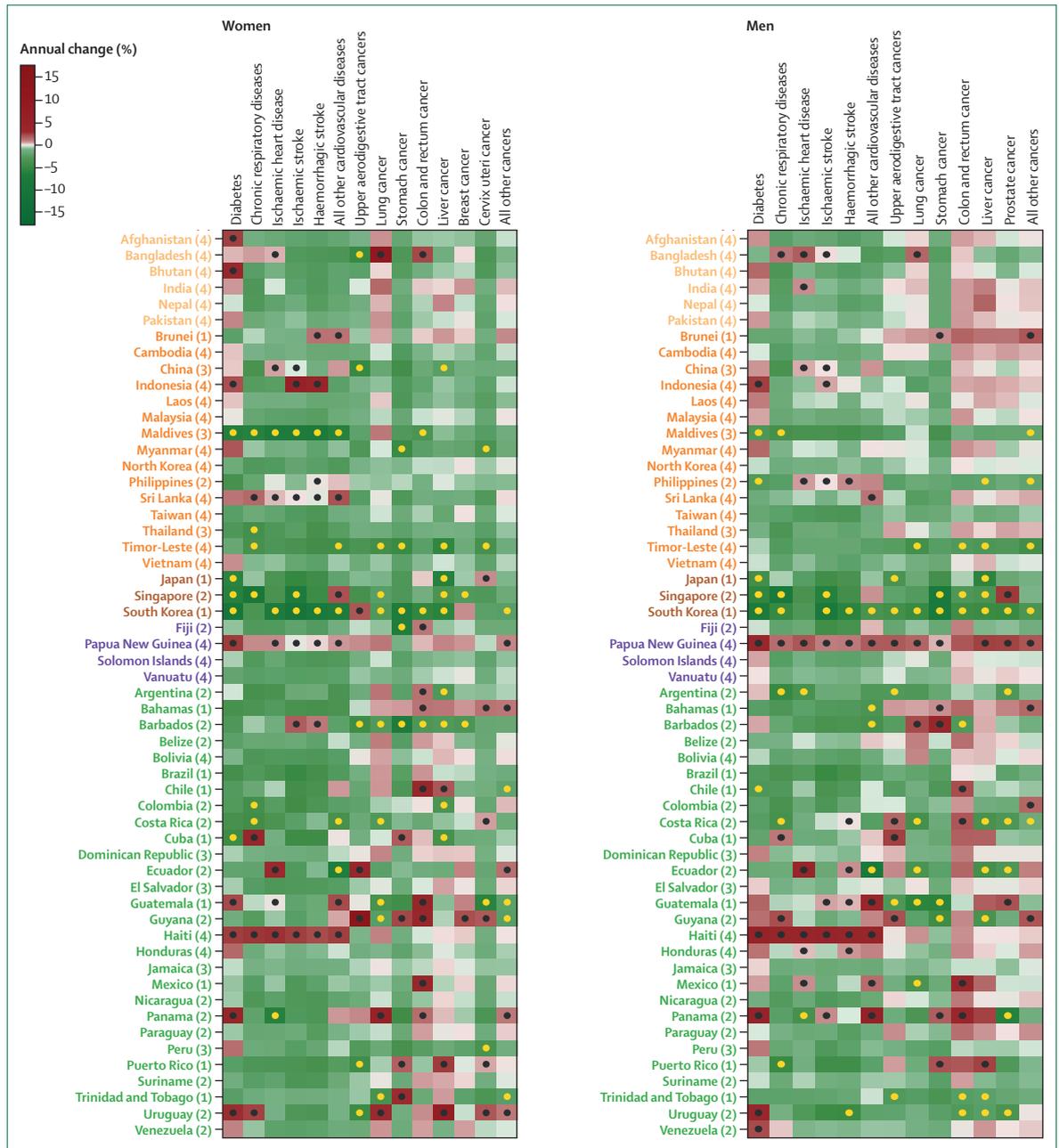
Trends in the risk of death from 2010 to 2016 varied considerably among NCD4 causes of death (figure 2). The risk of dying from ischaemic and haemorrhagic stroke, ischaemic heart disease, chronic respiratory diseases, and stomach cancer declined faster than that of other causes. By contrast, diabetes, colorectal cancer, liver cancer, breast cancer, prostate cancer, and the residual group of other cancers declined more slowly than other causes, as did lung cancer among women. For every NCD4 cause of death, except ischaemic and haemorrhagic stroke in women, at least 10% of countries had an increase in probability of premature death. For lung cancer in women, and colorectal, liver, and prostate cancers in men, the probability of premature death increased in more than half the countries. The median annual rate of change in the probability of dying

prematurely from various causes ranged from +0.2% per year for lung cancer to -2.5% per year for haemorrhagic stroke in women, and from +0.5% per year for colorectal cancer to -1.8% per year for haemorrhagic stroke in men. For no cause of death did the risk of premature death decline sufficiently fast for most countries to achieve a third reduction by 2030. For liver cancer, colorectal cancer, and the residual group of other cancers in women and men, and lung cancer in women, less than 10% of all countries were on track for a third reduction.

Figure 3 shows the average annual rate of change over 2010–16 in the probability of dying between 30 years and 70 years from NCD4 causes of death by country. Stomach cancer was the fastest declining cause in 45 (25.6%) countries in men and 40 (22.7%) countries in women (figure 3), followed by chronic respiratory diseases in men (37 [21.0%] countries) and ischaemic stroke in both men and women (33 [18.8%] countries). The probability of dying from all these causes is declining in 14 (8.0%) countries for men and in 16 (9.1%) countries for women. In 18 (10.2%) other countries for men and 25 (14.2%) for women, the probability of dying is declining for all but one cause. In Papua New Guinea, the probability of dying prematurely for every single cause of death is on the rise in men. In Haiti and Mauritania, the probability is on the rise for



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all causes of death but one for men. In a further 37 (21.0%) countries for men and 26 (14.8%) for women, the probability of death is rising for at least half of the causes of death.

Premature mortality from a larger number of NCD4 causes of death is declining for high-income countries in Asia-Pacific compared with other regions. Premature mortality from many of these causes is also declining in east and southeast Asia and central Asia, the Middle East, and North Africa for women, and the high-income western countries and central and eastern Europe for

men. The least favourable changes in the probability of death from these causes were seen in sub-Saharan Africa, and for men in south Asia and Oceania. Among high-income countries, the USA did badly, with probability of death from all but three causes of death increasing in both men and women.

Pathways to achieving SDG target 3.4

As stated earlier, women in 17 countries and men in 15 countries are already on track to meet SDG target 3.4. To investigate the options for other countries to achieve



Figure 3: Yearly percentage change from 2010 to 2016 in probability of dying between 30 years and 70 years of age from NCD4 causes of death by country. The cells marked with a gold dot show country-disease combinations that were in the fastest 10% of declines. The cells marked with a black dot show country-disease combinations that were in the slowest 10% of declines. See appendix pp 38–39 for results on all non-communicable diseases plus suicide between birth and 80 years of age. NCD4=four non-communicable diseases including cancers, cardiovascular diseases, chronic respiratory diseases, and diabetes.

this target, we constructed a series of scenarios that each define a specific combination of reductions in the risk of premature death from NCD4 causes of death. To construct the scenarios, two types of decline for each NCD cause of death were considered: fast (or ambitious) and average.

The fast decline corresponds to the probability of premature death for a cause of death declining at the same (annual) rate as the tenth best performing percentile of all countries (the countries that fall in the top 10% for each disease are marked with a gold dot in figure 3). The average decline corresponds to the probability of premature death for a cause declining at the same (annual) rate as the median of all countries. For both types of decline, in countries where the decline is already faster than the benchmarks, their own rate of decline was used. For

causes of death in which median change indicated an increase in the probability of premature death (lung cancer among women and colorectal, liver, and prostate cancers among men; figure 2), a zero rate of change was applied so that guidance on pathways does not suggest a rise in mortality. For each scenario and each country, we evaluated whether the specific combination of reductions in cause-specific probabilities of death would be sufficient to achieve SDG target 3.4 (appendix pp 8–9). The successful scenarios represent the pathways to SDG target 3.4 available to each country (appendix pp 21–22).

These scenarios frame the reduction in premature mortality in each cause of death based on the actual experience and achievement of all countries in the world. These choices of benchmarks imply that all

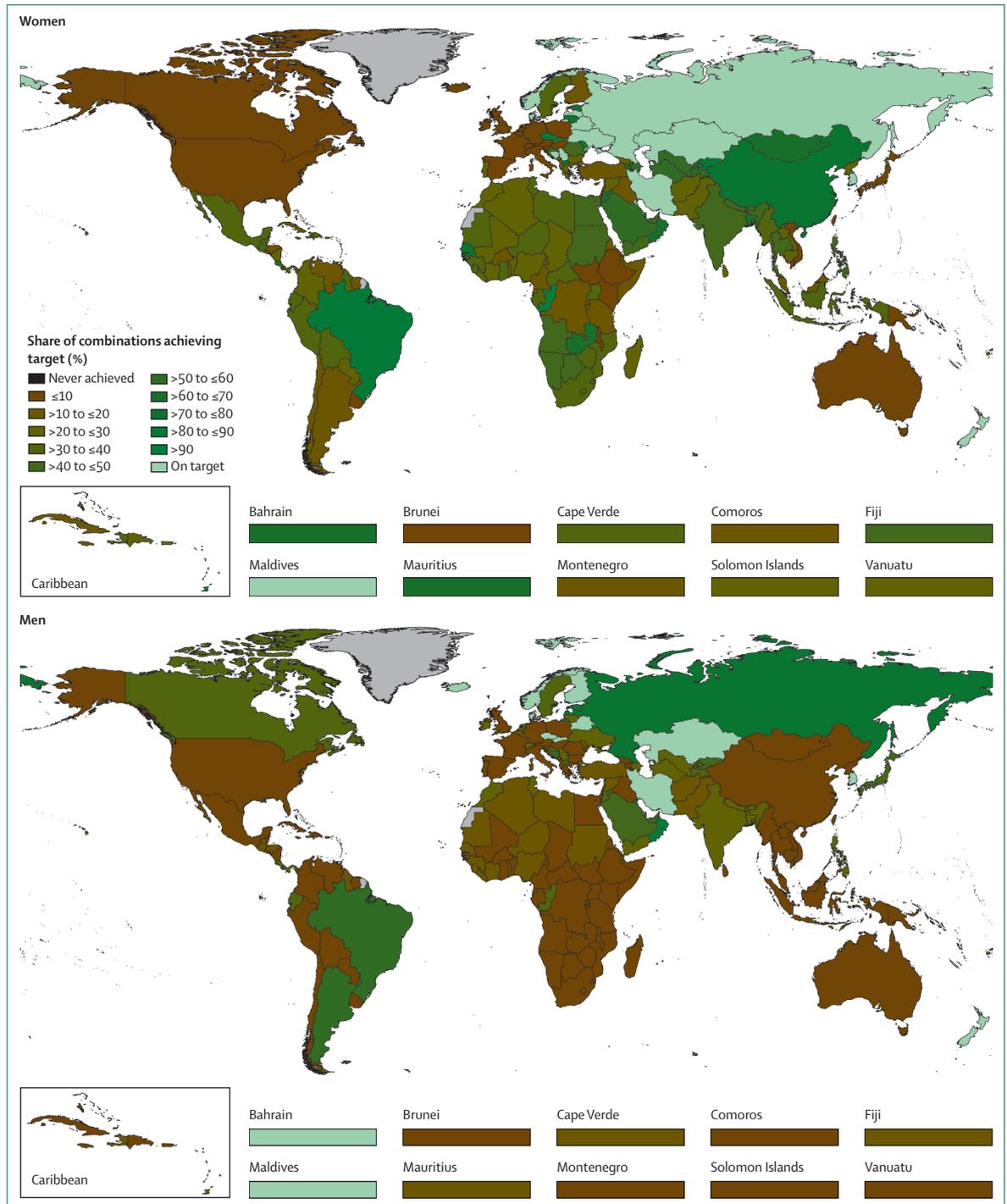


Figure 4: Percentage of all possible cause-of-death reduction scenarios that would achieve Sustainable Development Goal target 3.4 in each country. Each scenario represents one combination of fast (or ambitious) and average declines in probability of premature death from the different causes of death.

countries could do as well as the median country in reducing cause-specific mortality and that a decline, as large as the tenth percentile of best performing countries, although ambitious, is within reach. This approach is complementary to modelling the role of

specific interventions,^{6,7} which shows the potential of specific actions but might miss out on what is not measured or modelled. Achieving the sort of reductions envisioned by these scenarios requires appropriate financing, infrastructure, and policies.



(Figure 5 continues on next page)



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Whether a scenario is successful in achieving a third reduction in a country depends on two things: firstly, the baseline risk of death in that country in 2015 from each of the NCD4 causes of death, and secondly, the fast and average rates of decline for each of those causes of death in that scenario. If the scenario allocates the fast rate of decline to causes of death with higher baseline risks in that country, and if those fast rates of decline are sufficiently rapid to achieve a third reduction by 2030, then the scenario reduces the risk of premature

death to achieve SDG target 3.4. Otherwise, the needed reduction will not be achieved by that scenario. Therefore, the difference between countries with many versus few successful scenarios is that the former have more deaths in causes of death that are declining more rapidly (eg, stroke, stomach cancer, and chronic respiratory diseases; figure 2) than the latter (appendix pp 10–11).

With 14 causes of death for women and 13 causes of death for men, there were 16 384 (2¹⁴) scenarios for

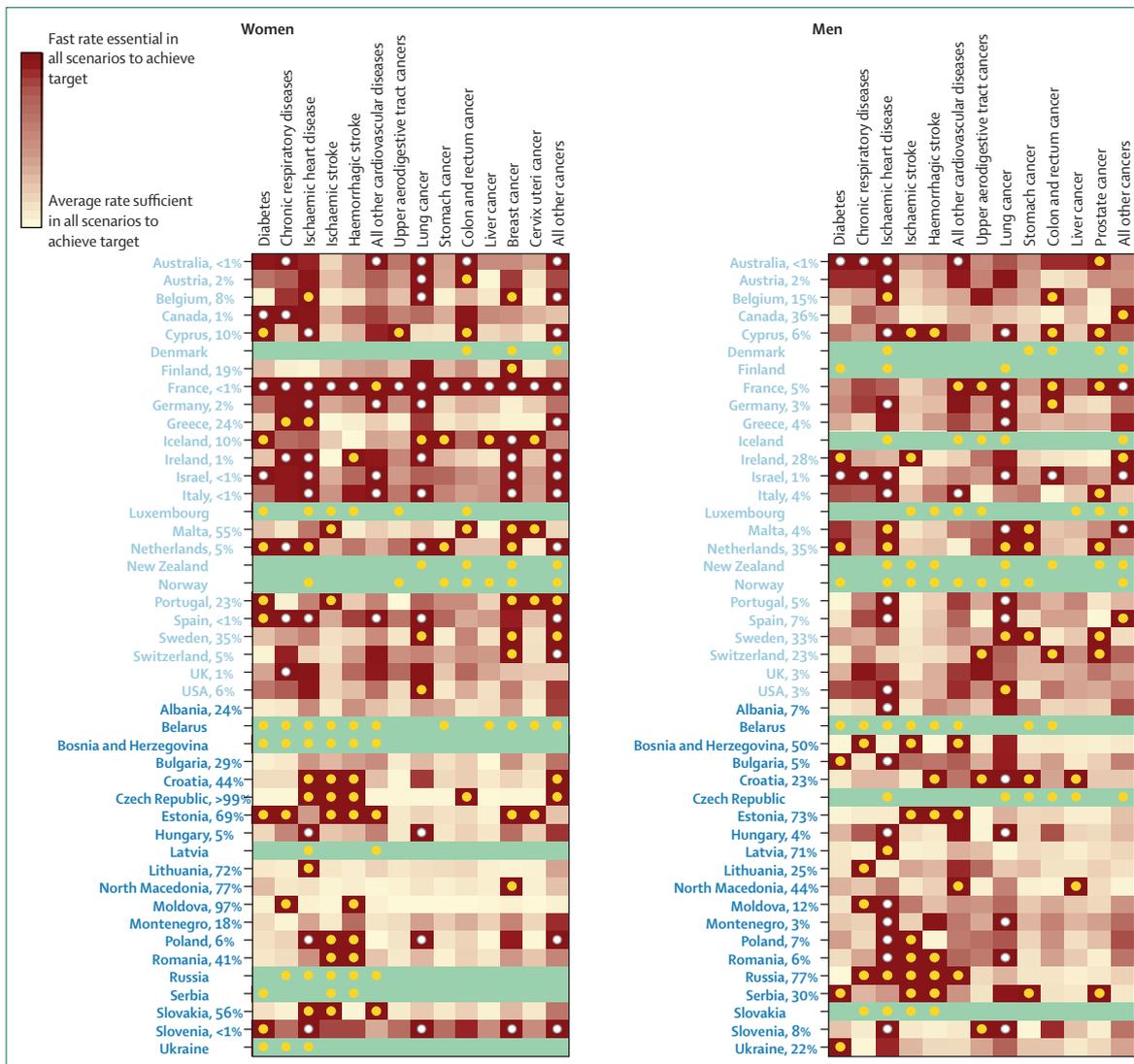


Figure 5: The degree of necessity of a fast decline for different causes of death for achieving SDG target 3.4 in each country

For each cause of death in each country the share of successful scenarios (ie, those that meet SDG target 3.4) in which that cause of death is allocated the fast versus the average rate of decline is depicted. If a cause of death accounts for only a small share of NCD4 deaths between people aged 30 years and 70 years, then the cause will not require the fast rate in the successful scenarios and the median rate will suffice. Conversely, if a cause of death accounts for a large share of NCD4 deaths in a country, especially one for which the global median decline is slow, then a high percentage of scenarios must include the fast decline to achieve success. The numbers next to each country show the percentage of all possible disease reduction scenarios that would achieve SDG target 3.4 (values from figure 4). Countries in pale green are those that are already on track to achieve the target. The cells marked with a gold dot show cause-of-death and country combinations in countries that were in the fastest 10% of declines. The cells marked with a grey-white circle show causes-of-death and country combinations for countries in which a fast decline was necessary for all successful scenarios. SDG=Sustainable Development Goals. NCD4=four non-communicable diseases including cancers, cardiovascular diseases, chronic respiratory diseases, and diabetes.

women and 8192 (2¹³) scenarios for men. Figure 4 shows the percentage of scenarios that would achieve SDG target 3.4 for each country and sex. Every country in the world has some options to achieve SDG target 3.4. There is, however, substantial variation in the options available to countries, with the share of scenarios that could achieve SDG target 3.4 ranging from less than 1% for women in eight countries and men in 12 countries to over 50% for women in 29 countries and men in eight countries. In most countries, there are more options to achieve the target for women than for men. Men in most

high-income western countries, sub-Saharan Africa, Latin America and the Caribbean, and east and southeast Asia have the potential to achieve SDG target 3.4 with less than 10% of scenarios. There were typically fewer options for women in high-income western countries than in other regions.

At the extreme, if every NCD4 cause of death declined at the same rate as the tenth best performing percentile of all countries, the overall probability of dying from NCD4 between 30 years and 70 years of age would decline by 33–51% for women and 34–52% for men in different

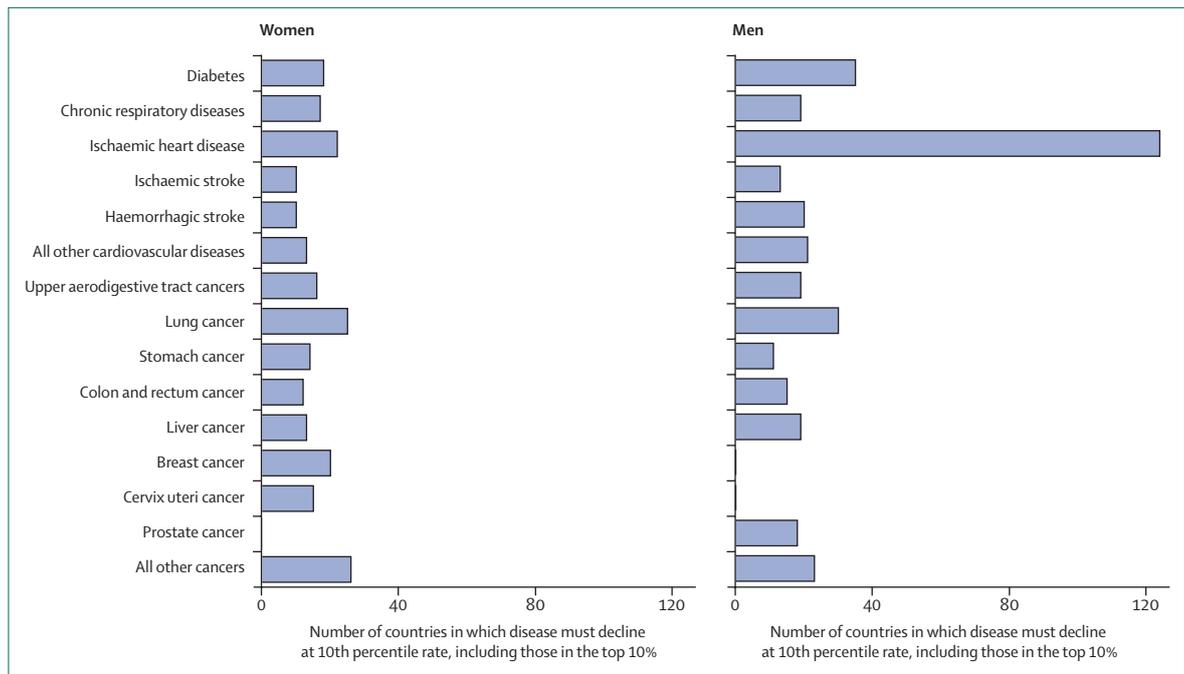


Figure 6: Number of countries in which a cause of death must be declining with a fast trend to achieve SDG target 3.4
 The numbers exclude countries that are already on track to achieve SDG target 3.4 (shown in pale green in figures 4, 5) but include countries in which the decline is already in the top 10%. SDG=Sustainable Development Goal.

countries (appendix pp 23–25). The median decline would be 42% for women and 38% for men.

What are the priority diseases in each country?

No country can achieve SDG target 3.4 by addressing a single cause of death. Rather, the minimum number of causes requiring a decline at the fast rate in a successful scenario in any country was two for women and three for men, although in most countries even more causes would have to be ambitiously improved at the same time. For example, in half of the countries, successful scenarios require improving the rate of decline in at least five causes of death to that of the tenth best performing percentile of all countries for women, and that of seven causes for men.

Figure 5 shows how often each cause had to be on a fast-track in successful scenarios for each country, which measure the degree of necessity of reducing each cause of death at the fast rate to achieve the target. In addition to providing information for individual countries, a few regional or global patterns arise: women in high-income western countries generally require a faster decline in the risk of dying from a greater number of causes of death than in other regions, than do men in the same region. As an extreme example, women in France would need a fast decline in every single cause of death to achieve a third reduction in probability of dying from NCD4 between 30 years and 70 years (appendix pp 10–11). This situation arises from the fact that deaths in women aged between 30 and 70 years in high-income countries are spread across many causes (figure 1), all of which

would have to be reduced at a fast rate to lower the overall risk of death within the SDG time frame.

Fast reductions in ischaemic heart disease deaths are necessary so that men in most countries achieve SDG target 3.4. For men and women in many high-income western countries, and men in central and eastern Europe and east and southeast Asia, fast reductions in lung cancer deaths are also necessary to achieve the target, as are fast reductions in deaths from liver cancer and haemorrhagic stroke for men in east and southeast Asia. Diabetes mortality would have to decline fast in all countries in Oceania, and for men in many countries in Latin America and the Caribbean, and sub-Saharan Africa, whereas reducing breast cancer deaths at a fast rate is necessary for women in many high-income western countries and in Japan. Finally, fast reductions in mortality for the heterogeneous group of other cancers are necessary to meet SDG target 3.4 in many high-income western and Asia-Pacific countries, and for women in central and eastern Europe.

Across all countries, the causes of death that must decline at the same rate as the tenth best performing percentile of all countries to achieve the target are seen in figure 6. For women, these were a diverse group, with slightly more countries requiring a fast decline in deaths from lung cancer, ischaemic heart disease, and the aggregate group of other cancers than for other causes. For men, ischaemic heart disease, which consistently posed a higher risk of death than other causes (figure 1), must decline rapidly in 124 (70.5%) countries to achieve

SDG target 3.4, followed by a much smaller number of countries for diabetes (which has shared causes and interventions with ischaemic heart disease and other cardiovascular diseases), lung cancer, and the cluster of other cancers. Results by region are summarised (appendix pp 44–46).

NCD mortality beyond SDG target 3.4: diseases and age groups

The indicator for SDG target 3.4 excludes NCDs other than NCD4 and deaths in people younger than 30 years of age, and 70 years and older. In 2015, which is the baseline year for SDGs, there was a total of 39.7 million NCD deaths in the 176 countries in our analysis. An estimated 1.7 million NCD deaths were in people younger than 30 years of age (4% of all 39.7 million NCD deaths; 18% of all 9.6 million deaths in this age group, with the remaining 82% of 9.6 million deaths from injuries and communicable, maternal, perinatal, and nutritional conditions). Of these, about 0.6 million deaths were estimated to be from NCD4 and 1.2 million from all other NCDs. Deaths from NCDs other than NCD4 in people aged between 30 and 70 years were not included in the indicator. These causes of death were responsible for 2.6 million deaths, accounting for 17% of all 15.0 million NCD deaths in those aged between 30 and 70 years. In addition, an estimated 23.0 million NCD deaths in people aged 70 years and older (58% of all NCD deaths) are not included. Of these, an estimated 10.2 million were in people aged 70–79 years, and 12.8 million in people aged 80 years and older. 18.9 million of these deaths were from NCD4 and 4.1 million from other NCDs.

The previous NCD Countdown paper³ showed that the risk of dying from NCDs other than NCD4 and in age groups other than those between 30 and 70 years is higher in low-income and middle-income countries than in high-income countries. Many of these causes of death also share interventions with NCD4. For example, chronic kidney disease, which is not included in NCD4, is affected by some of the same risk factors and interventions as diabetes and cardiovascular diseases, which are included. For these reasons, NCD Countdown 2030 also reports on deaths from all NCDs as well as suicide (as a mortality indicator for mental health) in people less than 80 years of age.³ In 2015, there were an estimated 0.79 million deaths by suicide in the world. 0.23 million (29%) of these were people aged younger than 30 years, 0.45 million (57%) were between ages 30 years and 70 years, and the remaining 0.12 million (15%) were 70 years and older.

Results for all NCDs plus suicide and the broader age group of birth to 80 years of age are shown in the appendix pp 26–42. The probability of dying prematurely from all NCDs and suicide between birth and 80 years of age was highest in sub-Saharan Africa and central Asia for both sexes, and in eastern Europe for men (appendix pp 26–28).

Among non-NCD4 causes of death, liver cirrhosis, kidney and other genitourinary diseases, neurological conditions, and mental and substance-use disorders and suicide are all responsible for substantial risk of dying before 80 years of age, especially in low-income and middle-income countries (appendix pp 29–30). The rate of change in the probability of dying before 80 years of age from these causes of death is highly variable across countries, with many countries having had an increase. In particular, the risk of dying from neurological conditions between birth and 80 years of age has increased for more than half of countries (appendix pp 36–37). The pathways analysis of feasible reductions in mortality shows that, if every one of these causes of death declined at the same annual rate as the tenth best performing percentile of all countries, the probability of dying before 80 years of age from all NCDs plus suicide would decline by 31–44% for women and 26–40% for men in different countries (appendix pp 40–42). The median decline would be 36% for women and 30% for men.

Leveraging the pathways to achieve SDG target 3.4

The analysis of pathways shows that, based on actual experience in reducing NCD mortality in countries with good performance, every country has one or more pathways to achieve target SDG 3.4 by 2030. Nonetheless, for many countries doing so is an ambitious task and requires tackling several NCDs to the same extent as achieved by the best performing nations. The pathways analysis also revealed that neither globally nor regionally does a specific cause of death emerge as a single solution for achieving SDG target 3.4. Large reductions in the risk of death from ischaemic heart disease are necessary so that many countries can achieve the target for men. For women, various cancers, diabetes, and chronic respiratory diseases must also be tackled. Importantly, successful scenarios require achieving the same reduction as the best performing countries for several causes of death.

NCDs have several social, environmental, behavioural, nutritional, and clinical determinants. The diverse disease-specific pathways show that reducing the burden of NCDs to achieve SDG target 3.4 requires a combination of prevention, early detection, and treatment.^{5,8} With cardiovascular diseases, chronic respiratory diseases, diabetes, and some cancers requiring large reductions, essential components of any strategy to achieve SDG target 3.4 include tobacco and alcohol control, detection and treatment of hypertension and diabetes, primary and secondary prevention of cardiovascular diseases in high-risk individuals through multidrug treatment, and low-dose inhaled corticosteroids and bronchodilators for asthma and selected patients with chronic obstructive pulmonary disease.^{5–7,9,10} Experiences from high-income countries show that these population-based and primary care interventions, although essential and effective on their own do not lead to large enough reductions to

achieve SDG target 3.4. Rather, substantially reducing cardiovascular disease and respiratory disease mortality also requires high-quality care, including treatment of acute cardiovascular disease, acute exacerbations of asthma and chronic obstructive pulmonary disease, and acute complications of diabetes, at first-level (eg, district), regional, and specialist hospitals.^{10–17}

The pathways analysis also showed the importance of reducing deaths from cancers for achieving SDG target 3.4. Tobacco control, and, to a lesser extent, alcohol control, are effective interventions against cancers with benefits emerging within a few years.^{6,7,9} Vaccinations against human papillomavirus and hepatitis B virus are highly effective cancer-prevention measures for cervical and liver cancers, which cause a large number of deaths, especially in low-income and middle-income countries,^{5,9,18,19} and should be used in all countries. Although of essential importance, the benefits of immunisation on mortality will materialise decades beyond the current targets. In the interim, leveraging the pathways to SDG target 3.4 requires closing the cancer diagnosis and survival gap between high-income countries and low-income and middle-income countries²⁰ through screening. This approach will allow earlier diagnosis during precancerous or early stages of disease, followed by treatment of those cancers with effective treatment.^{9,19} An assessment of specific interventions for different NCDs, together with estimates of the costs of these interventions and the opportunities and challenges for their implementation, is detailed in a forthcoming NCD Countdown 2030 analysis.

The diverse national pathways show that accelerating progress towards SDG target 3.4 requires two important considerations. First, national NCD strategies based on the combination of local epidemiology and feasibility, and second, an accessible and equitable health system that integrates population-based prevention with the entire continuum of care (appendix p 12)—from primary care to secondary and specialist hospital care with effective and efficient referral pathways and the ability to retain patients in long-term care—¹⁷ rather than isolated and vertical programmes.²¹ Such an integrated approach is challenging in low-income countries, which continue to face a substantial burden of infectious diseases, epidemic outbreaks (such as Ebola and COVID-19, which influence acute and chronic care for NCDs), and humanitarian crises. Putting in place mechanisms for early diagnosis, appropriate and efficient referral, and long-term care for NCDs would better prepare health systems to deal with other chronic and acute conditions. Creating such a system requires additional financing for NCDs,²² aligning the NCD agenda with efforts to achieve accessible and equitable national health systems through universal health coverage,²³ and strengthening the capacity for priority setting²⁴ and implementation of NCD care within the health system.

Contributors

RBe, RBo, KD, LMR, and ME developed and established the NCD Countdown initiative. ME developed the pathways analysis concept. JEB, VK, MG, CDM, and ME developed analytical design with input from other authors. JEB and VK analysed data and presented results with input from other authors. ME, JEB, and VK wrote the first draft of the paper, with input from other authors. ME oversaw the study.

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