The Heart of 25 by 25: Achieving the Goal of Reducing Global and Regional Premature Deaths From Cardiovascular Diseases and Stroke

A Modeling Study From the American Heart Association and World Heart Federation

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ABSTRACT

In 2011, the United Nations set key targets to reach by 2025 to reduce the risk of premature noncommunicable disease death by 25% by 2025. With cardiovascular disease being the largest contributor to global mortality, accounting for nearly half of the 36 million annual noncommunicable disease deaths, achieving the 2025 goal requires that cardiovascular disease and its risk factors be aggressively addressed. The Global Cardiovascular Disease Taskforce, comprising the World Heart Federation, American Heart Association, American College of Cardiology Foundation, European Heart Network, and European Society of Cardiology, with expanded representation from Asia, Africa, and Latin America, along with global cardiovascular disease experts, disseminates information and approaches to reach the United Nations 2025 targets. The writing committee, which reflects Global Cardiovascular Disease Taskforce membership, engaged the Institute for Health Metrics and Evaluation, University of Washington, to develop region-specific estimates of premature cardiovascular mortality in 2025 based on various scenarios. Results show that >5 million premature CVD deaths among men and 2.8 million among women are projected worldwide by 2025, which can be reduced to 3.5 million and 2.2 million, respectively, if risk factor targets for blood pressure, tobacco use, diabetes mellitus, and obesity are achieved. However, global risk factor targets have various effects, depending on region. For most regions, United Nations targets for reducing systolic blood pressure and tobacco use have more substantial effects on future scenarios compared with maintaining current levels of body mass index and fasting plasma glucose. However, preventing increases in body mass index has the largest effect in some high-income countries. An approach achieving reductions in multiple risk factors has the largest impact for almost all regions. Achieving these goals can be accomplished only if countries set priorities, implement cost-effective population wide strategies, and collaborate in public-private partnerships across multiple sectors.

Key Words: *AHA Scientific Statements; cardiovascular diseases; forecasting; global health; premature mortality; prevention and control!5#*

The World Health Organization (WHO), empowered by unanimous proclamation at the United Nations high-level meeting on noncommunicable diseases (NCDs) in September 2011, set a number of key targets for all nations to reach by 2025 [1]. The overarching goal is to reduce the risk of premature deaths (defined as the probability of dying between the ages of 30 and 70 years) from NCDs (cardiovascular disease [CVD], including stroke, diabetes mellitus [DM], cancer, and chronic respiratory disease) by 25% by the year 2025 (referred to as 25 by 25). The Global Cardiovascular Disease Taskforce, comprising the World Heart Federation, American Heart Association, American College

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This document was approved by the American Heart Association Science Advisory and Coordinating Committee on December 4, 2015, and the American Heart Association Executive Committee on January 19, 2016.

The World Heart Federation requests that this document be cited as follows: Sacco RL, Roth GA, Reddy KS, Arnett DK, Bonita R, Gaziano TA, Heidenreich PA, Huffman MD, Mayosi BM, Mendis S, Murray CJL, Perel P, Piñeiro DJ, Smith SC Jr, Taubert KA, Wood DA, Zhao D, Zoghbi WA. The heart of 25 by 25: achieving the goal of reducing global and regional premature deaths from cardiovascular diseases and stroke: a modeling study from the American Heart Association and World Heart Federation. *Glob Heart* 2016;11:251–264. http://dx.doi.org/10.1016/j.gheart.2016.04.002.

This article has been copublished in *Circulation*.

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GLOBAL HEART
© 2016 Published by Elsevier Ltd. on behalf of World Heart Federation (Geneva).
VOL. 11, NO. 2, 2016
ISSN 2211-8160/$36.00.
http://dx.doi.org/10.1016/j.gheart.2016.04.002

of Cardiology Foundation, European Heart Network, and European Society of Cardiology, with expanded representation from Asia, Africa, and Latin America, along with global CVD experts, disseminates information and approaches to reach the WHO 2025 targets [2–4].

To achieve the overarching 25 by 25 target, the WHO identified 8 targets in the prevention, control, and treatment of 6 key risk factors, as well as 2 health systems targets related to the use of essential medicines, technologies, and drug therapies, to prevent NCDs, particularly CVDs [5]. Of the 8 targets, 6 directly align with traditional CVD and stroke risk factors: 3 risk factors (tobacco use, sodium intake, physical inactivity), 2 biological risk factors (raised blood pressure [BP], DM/obesity), and 1 management target directed at the treatment of individuals at high risk of CVD. With CVD as the largest single contributor to global mortality, accounting for nearly half of the 36 million annual NCD deaths, and with a global cost of nearly US $863 billion, achieving the global target to reduce premature NCD deaths by 25% requires that CVD and its risk factors be aggressively addressed by WHO member states, policy makers, professional organizations, public health experts, healthcare providers, and key stakeholders [4].

Although the prevalence of many of these risk factors has improved globally over the past 30 years, with the exception of DM and obesity, trends are not homogeneous (Table 1) [11]. Between 1990 and 2013, the age-standardized CVD death rate decreased by >22% for both ischemic heart disease and stroke [12]. With these trends taken into account, continued progress toward improving cardiovascular health and reducing CVD and stroke deaths is vital to reaching the overall premature NCD mortality goal by 2025, just 1 decade away. The aims of this document are to investigate the potential impact of reaching selected targets in the WHO Global Monitoring Framework on the reduction of premature CVD mortality by 2025 and to examine the policy implications of these predictions.

DATA AND METHODS

The writing committee reflects the members of the Global Cardiovascular Disease Taskforce. The committee engaged researchers at the Institute for Health Metrics and Evaluation, University of Washington, Seattle, to develop region-specific estimates of premature cardiovascular mortality in 2025 based on various scenarios. The Institute for Health Metrics and Evaluation is the coordinating center for the Global Burden of Disease (GBD) Study, a multinational effort to produce consistent estimates of death and disability by age, sex, and over time for all countries [12].

The methods and results of this exercise have been reported in detail [13]. Data were drawn from the GBD 2013 study [12]. All estimates were produced separately for each age/sex/country/disease-specific strata and then collapsed to create regional estimates. A list of GBD 2015 geographies detailing the countries that make up regions and superregions is available elsewhere [14].

To create a scenario in which risk factors continue the trend observed since 1990 ("business as usual"), the analysis first estimated the proportion of CVD and stroke deaths in 1990 and 2013 resulting from raised systolic BP, tobacco smoking, high body mass index (BMI), and high fasting plasma glucose using a population-attributable fraction. The effect of serum cholesterol was not included because it was not listed among the 8 primary WHO 25 by 25 targets.

The theoretical minimum risk exposure distribution used for the GDB 2010 study was applied except for systolic BP, for which a theoretical minimum limit of 115 mm Hg was adopted [15]. With the use of the annualized rate of change between 1990 and 2013, it was assumed that the remaining deaths unattributed to these risk factors would continue their observed trend. Beginning in 2014, deaths attributable to the selected risk factors were estimated from the same population-attributable fraction and risk factor exposures estimated for GBD 2013 for each age/sex/country/year projected to 2025 and the annualized rate of change between 1990 and 2013. Future scenarios were developed to match 4 key risk factor targets for 2025: no

TABLE 1. Trends in global cardiovascular health

	Global Prevalence			
	1980		2008–2012	
Metric	Men	Women	Men	Women
Tobacco use, % [6]	41.2 (40.0–42.6)	10.6 (10.2–11.1)	31.1 (30.2–32.0)	6.2 (6.0–6.4)
Mean systolic BP, mm Hg [7]	130.5 (127.3–134.0)	127.2 (124.1–130.6)	128.1 (126.7–129.4)	124.4 (123.0–125.9)
Raised BP, % [7]	33 (28–39)	29 (25–34)	29 (27–31)	25 (23–27)
Physical inactivity, % [8]	N/A	N/A	19.8 (13.4–32.1)	26.8 (18.5–38.9)
Obesity, % [9]	4.8 (4.0–5.7)	7.9 (6.8–9.3)	9.8 (9.2–10.4)	13.8 (13.1–14.7)
DM, % [10]	8.3 (6.5–10.4)	7.5 (5.8–9.6)	9.8 (8.6–11.2)	9.2 (8.0–10.5)

Values in parentheses are 95% uncertainty intervals.
BP, blood pressure; DM, diabetes mellitus; and N/A, not applicable.

further increase in fasting plasma glucose, no further increase in BMI, a 25% reduction in the prevalence of systolic BP >140 mm Hg via a shift in the entire population distribution of systolic BP, and a 30% reduction in tobacco smoking prevalence, including associated effects from secondhand smoke. For BP, modeling a population-wide shift in systolic BP assumes that there will be both prevention and treatment of hypertension, but no BP target is specified. The analysis also estimated a scenario in which all 4 of these targets are achieved, adjusting for their joint effects on mortality. The impact of access to medications was not modeled because comprehensive estimates do not yet exist.

RESULTS

2025 estimates of the absolute number of premature deaths from CVD

From the GBD data set, 3 736 540 deaths (95% uncertainty interval, 3 483 303–4 009 003) from CVD occurred in 2013 among men and 2 128 134 (95% uncertainty interval, 1 814 857–2 366 726) among women across the globe for individuals 30 to 70 years of age. Table 2 shows that, globally, more men die prematurely of CVD than women, although no significant difference can be observed in sub-Saharan Africa. For 2025, given population growth and assuming that trends in the selected risk factors continue, we estimate that 5 009 492 premature deaths from CVD among men (95% uncertainty interval, 4 632 942–5 389 257) and 2 769 945 among women (95% uncertainty interval, 2 321 954–3 044 866) will occur, a relative increase of 34% and 30% from 2013, respectively. Only among high-income countries, which include the United States, Canada, Australia, Western Europe, Japan, and South Korea, are there projected reductions in the absolute number of premature deaths of −19% among men and −16% among women in 2025. For the rest of world, the number of premature deaths from CVD is projected to increase from 22% in Latin America and the Caribbean to 48% in sub-Saharan Africa among women and from 16% in Central Europe, Eastern Europe, and Central Asia to 56% in South Asia among men, largely because of aging and growth of populations.

Compared with the business as usual estimates, the modeling showed major reductions in the number of premature deaths resulting from CVD among men and women across all regions if the 25 by 25 targets for raised BP, smoking, obesity, and DM were achieved by 2025. Overall, the model projected a relative decrease of 5% among men and only a 1% increase among women in the number of premature deaths resulting from CVD compared with the increases of 34% and 30% in the business as usual estimates. A significant difference between scenarios in number of premature deaths caused by CVD in 2025, with no overlap of 95% uncertainty intervals, was seen globally for men and within the region made up of Southeast Asia, East Asia, and Oceania. Although there are projected increases from 2013 to 2025 in the absolute number of premature deaths in some regions, the 2025 estimates for the number of deaths in all regions were much improved if the risk factor targets were achieved.

2025 estimates of probability of premature mortality from CVD

The figures illustrate the global and regional projections for achieving a reduction in the probability of premature mortality from CVDs, including stroke by 2025. Figure 1 shows the global probability of premature death in women 30 to 70 years of age resulting from CVD using data from 1990 to 2013 and projects these estimates from 2014 to 2025. Notably, recent declines in premature CVD mortality leveled off if risk factors continued the current trend. There was a small estimated reduction in premature mortality if the increase in fasting plasma glucose was halted. A similar magnitude of decline was estimated if the prevalence of smoking was reduced by 30%. Next, a more modest reduction in premature mortality would be realized by halting the increase in elevated BMI. The most robust effect from a single risk factor target being met resulted from the achievement of the BP goal of reducing the prevalence of elevated systolic BP by 25%. An important assumption of this model is that the entire population distribution of 25% was shifted leftward to achieve the target, which includes reduction of systolic BP both >140 and <140 mm Hg. Shifts of this magnitude reflect an assumption that hypertension is both prevented, via dietary and lifestyle modification, and treated medically, via antihypertensive therapies. However, 2 key observations of the modeling exercise are that the single dominant risk factor strategy varied by region and that the combined strategy dominated in almost all regions. The combined scenario if all 4 risk factor targets were achieved by 2025 would result in achieving the 25 by 25 mortality goal for women in 2025 or shortly thereafter.

For men, the projections for the global probability of premature death caused by CVD differed (Figure 2). First, the risk of premature death from CVD was greater for men than women, and the scenario in which current trends continue to 2025 was estimated to lead to an increased premature probability of death in 2025 compared with 2013. If either the increase in fasting plasma glucose or elevated BMI was halted, then the effects on the premature CVD mortality among men was less than that for women, and no reduction in the risk of premature CVD mortality by 2025 could be detected because uncertainty estimates for 2013 and 2025 overlapped. Achieving the target for smoking would have a similar impact on men and women, reducing the risk of premature mortality by ≈4%. As among women, the BP goal also had the most profound impact on reducing premature mortality from CVD. The scenario if all 4 risk factor targets were achieved in 2025 resulted in achieving the overall goal by about 2025 for both men and women.

TABLE 2. Absolute numbers of premature cardiovascular deaths in 2013 and estimates in 2025 for adults 30 to 70 years of age by superregion

Region	Sex	Premature Cardiovascular Deaths, 2013 (95% Uncertainty Interval), n	Premature Cardiovascular Deaths in 2025 if Current Risk Factor Trends Continue (95% Uncertainty Interval)	Change in Mean No. of Deaths, 2013–2025, %	Premature Cardiovascular Deaths in 2025 if Risk Factor Targets Are Achieved (95% Uncertainty Interval)	Change in Mean No. of Deaths, 2013–2025, %
Global	Women	2 128 134 (1 814 857–2 366 726)	2 769 945 (2 321 954–3 044 866)	30	2 159 217 (1 827 170–2 393 080)	1
Global	Men	3 736 540 (3 483 303–4 009 003)	5 009 492 (4 632 942–5 389 257)	34*	3 539 896 (3 316 386–3 804 971)	−5†
High income	Women	164 786 (148 636–205 642)	138 356 (124 811–172 797)	−16	127 186 (114 450–158 685)	−23
High income	Men	362 839 (342 716–383 975)	293 289 (276 513–311 016)	−19*	266 359 (250 676–283 268)	−27*
Central Europe, Eastern Europe, and Central Asia	Women	223 696 (207 857–243 869)	281 455 (245 400–302 032)	26*	227 418 (195 576–246 731)	2
Central Europe, Eastern Europe, and Central Asia	Men	475 936 (461 227–490 469)	553 462 (531 778–574 519)	16*	410 376 (389 566–430 121)	−14*†
Sub-Saharan Africa	Women	200 443 (177 291–240 632)	296 141 (257 813–347 694)	48*	237 249 (207 346–282 389)	18
Sub-Saharan Africa	Men	231 248 (216 576–247 674)	350 375 (327 371–374 645)	52*	289 286 (269 767–311 035)	25*†
North Africa and Middle East	Women	147 122 (130 915–163 220)	194 795 (173 397–217 242)	32*	168 165 (149 818–187 378)	14
North Africa and Middle East	Men	220 032 (204 031–238 444)	295 956 (274 405–319 530)	35*	247 057 (228 401–267 836)	12†
South Asia	Women	639 046 (469 768–794 972)	916 908 (665 308–1 130 215)	43	736 819 (532 380–910 343)	15
South Asia	Men	1 097 544 (904 270–1 317 289)	1 717 276 (1 418 260–2 039 056)	56*	1 223 642 (1 020 301–1 457 277)	11†
Southeast Asia, East Asia, and Oceania	Women	626 804 (537 293–720 433)	788 050 (672 937–899 995)	26	535 645 (461 842–609 289)	−15†
Southeast Asia, East Asia, and Oceania	Men	1 163 003 (1 017 097–1 282 170)	1 568 704 (1 373 123–1 748 215)	35*	912 417 (814 746–1 000 303)	−22*†
Latin America and Caribbean	Women	126 235 (115 538–147 773)	154 240 (140 363–179 209)	22	126 736 (115 135–147 858)	0
Latin America and Caribbean	Men	185 937 (175 438–196 925)	230 430 (217 845–242 639)	24*	190 760 (180 293–201 545)	3†

*The 95% uncertainty intervals for numbers of deaths in 2013 and 2025 do not overlap.
†The 95% uncertainty intervals for numbers of deaths in 2025 scenarios do not overlap.

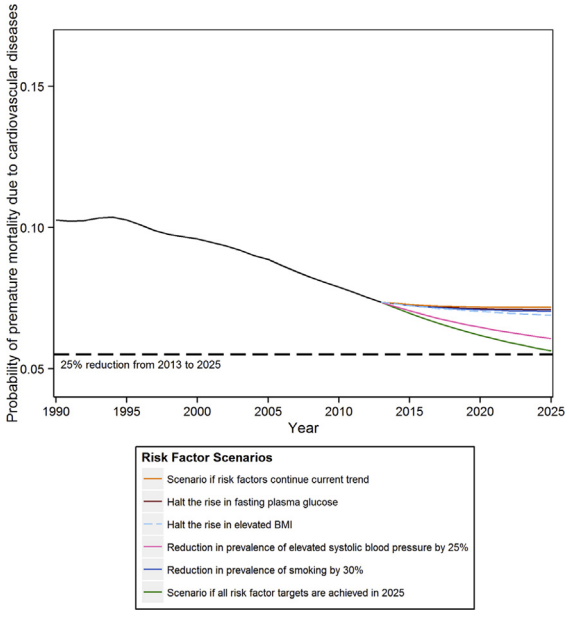

FIGURE 1. Global probability of premature death in women 30 to 70 years of age resulting from cardiovascular disease. BMI, body mass index.

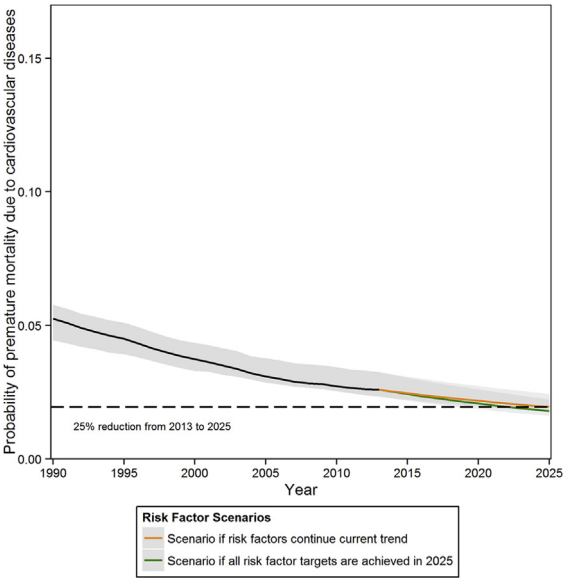

FIGURE 3. Probability of premature death resulting from cardiovascular disease in women between 30 and 70 years of age in high-income countries.

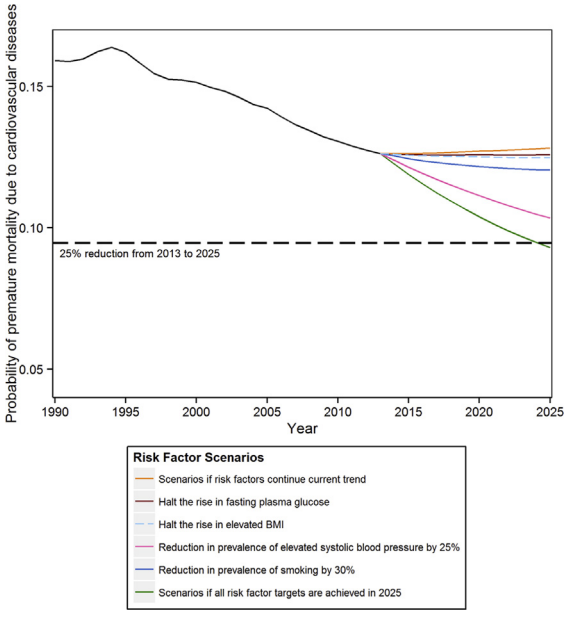

FIGURE 2. Global probability of premature death in men 30 to 70 years of age resulting from cardiovascular disease. BMI, body mass index.

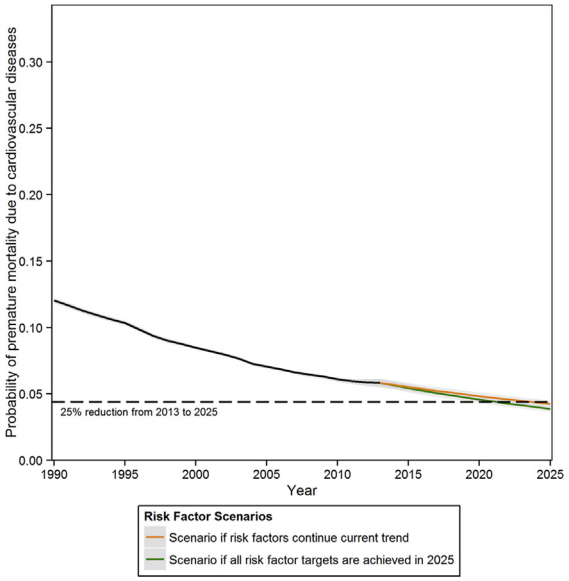

FIGURE 4. Probability of premature death resulting from cardiovascular disease in men between 30 and 70 years of age in high-income countries.

The regional variation in the probability rates for premature CVD mortality was striking, and the effects of achieving the targets are demonstrated in the figures. For high-income countries, among men and women (Figures 3 and 4), the 2025 premature CVD mortality target was achieved if current trends continued but would be achieved ≈5 years sooner if all 4 risk factors targets were achieved. Higher premature CVD mortality rates were estimated in Eastern Europe/Central Asia (Figures 5 and 6), sub-Saharan Africa (Figures 7 and 8), North Africa/Middle East (Figures 9 and 10), South Asia (Figures 11 and 12), East Asia/Pacific (Figures 13 and 14), and Latin America/Caribbean (Figures 15 and 16) if current trends continued. Achieving the 4 risk factor goals by 2025, however, resulted in the overall 25 by 25 target being achieved on average in high-income regions, North Africa/Middle East, East Asia/Pacific, and Latin America/Caribbean for men and women. There is substantial measurement uncertainty for these estimates, particularly in South Asia.

DISCUSSION

The data illustrate the substantial variability in the global burden of premature mortality from CVD with much greater probability of cardiovascular death in low- and middle-income countries than in high-income countries. Given that increased systolic BP, smoking, overweight and obesity, and DM are highly prevalent in many populations and increase the risk of CVD death [16], achieving all 4 of these risk factor targets will contribute to a reduction in the risk of premature mortality from CVD in about the year 2025 globally. A key finding of our exercise is that, globally and for almost regions, targeting all 4 of these risk factors leads to greater reductions in CVD death than targeting any single risk factor. However, the absolute impacts of the WHO 25 by 25 priority targets both in combination and independently differ significantly by world region.

Globally, the targets for systolic BP (reduce by 25%) and tobacco use (reduce by 30%) have more substantial effects on the future scenarios compared with maintaining current levels of BMI and fasting plasma glucose. However, this general observation is not true for all regions, notably high-income North America and Australasia, where a reduction in BMI among women dominates as a strategy [13]. Tobacco reduction is the largest contributor to mortality reductions for women in Western Europe and high-income Asia Pacific and men in North Africa/Middle East, central sub-Saharan Africa, and Central Asia [13]. Because there is substantial regional variability in these projections, regions and countries will need to develop, prioritize, implement, and evaluate context-specific approaches to addressing these targets. Projections of future trends can be helpful for setting priorities in certain regions. Although the order of importance of reaching the individual risk factors varies somewhat by region, the uncertainty intervals largely overlap, and the best scenario for reaching the 25 by 25 goal is to accomplish all 4 key risk factor targets.

Although the analyses focused on the 4 main risk factor targets, attention needs to be focused on the other targets that involve improving the capacities of healthcare systems to accomplish CVD risk reduction. Two of the WHO targets could not be modeled: 50% of eligible people receiving drug therapy and counseling, including glycemic control, to prevent heart attacks and strokes and 80% availability of the affordable basic technologies and essential medicines, including generics, required to treat major NCDs in both public and private facilities. It is also important to recognize in the interpretation of the projections that many of the 8 WHO global targets are interdependent. For example, to achieve the 2025 WHO targets for BP and DM, major efforts to strengthen healthcare systems will be required.

Policy implications

There are several policy implications of these findings. First, these results demonstrate that the greatest reduction in premature mortality can be achieved for most regions of the world by targeting a combination of risk factors. Second, more ambitious risk factor targets will be needed for fasting plasma glucose and BMI if they are to make a substantial contribution to risk reduction. A more ambitious tobacco target would also influence non–cardiovascular-related deaths such as those secondary to cancer and chronic lung disease, which were not included here.

To reduce BP, all 3 pillars of the global strategy for the prevention and control of NCDs will be important to address: surveillance, prevention, and health care delivered through strengthened health systems. These recommendations are described in detail in prevention guidelines produced by multiple organizations [6,7,16–19] and by the WHO in its package of essential NCD interventions for primary health care [17]. Prevention strategies and goals for reducing population mean levels of BP, including the WHO target of a 30% relative reduction in mean population intake of salt/sodium, are important components that can be provided largely by population-wide interventions and policies aimed at improving the healthfulness, availability, and affordability of the local and regional food supply.

Third, projections of future mortality based on the best available data on risk factor exposure and relative risk can serve as a useful summary measure when WHO member states and other stakeholders are setting priorities. To achieve the 25 by 25 mortality goal (Table 3), policy decisions will need to reflect not only the cost-effectiveness of an intervention targeting a particular risk factor but also local trends in the absolute level of exposure to that risk factor. Additional investments in health surveillance will therefore be an essential component of evidence-based decision making [18,19].

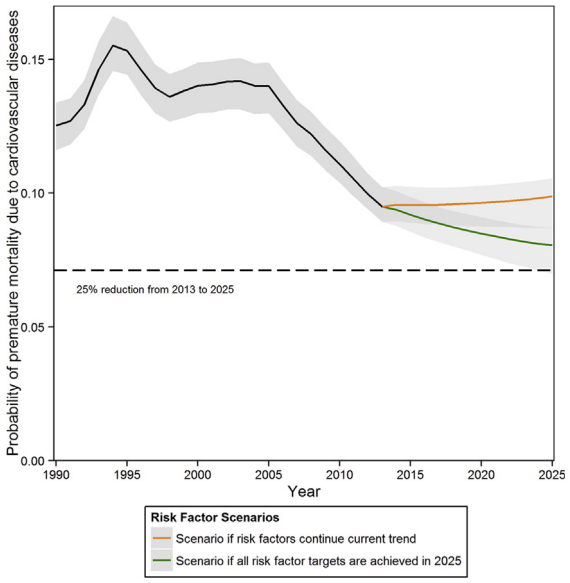

FIGURE 5. Probability of premature death resulting from cardiovascular disease in women between 30 and 70 years of age in Eastern Europe/Central Asia.

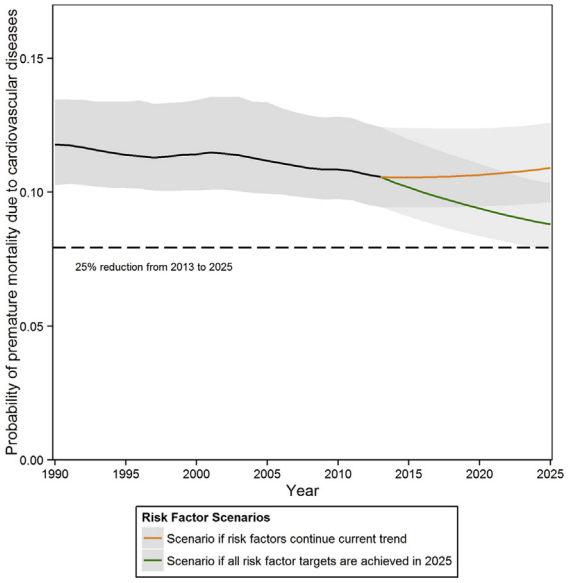

FIGURE 7. Probability of premature death resulting from cardiovascular disease in women between 30 and 70 years of age in sub-Saharan Africa.

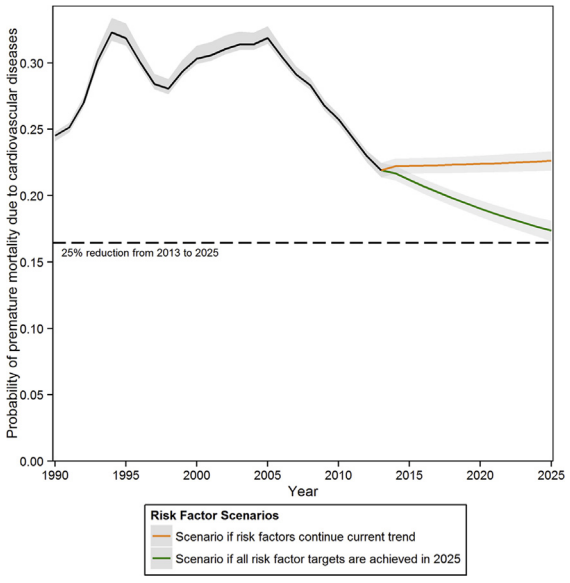

FIGURE 6. Probability of premature death resulting from cardiovascular disease in men between 30 and 70 years of age in Eastern Europe/Central Asia.

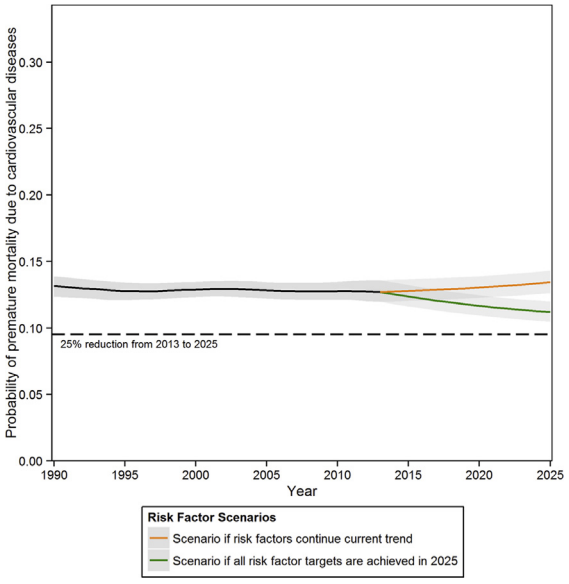

FIGURE 8. Probability of premature death resulting from cardiovascular disease in men between 30 and 70 years of age in sub-Saharan Africa.

Evidence-based prevention and treatment of CVD in low-/middle-income countries

Although the model was unable to incorporate the impact of healthcare system changes on primary and secondary prevention, improving access to evidence-based approaches to the management of risk to prevent and treat CVDs will be critical to achieving the 2025 goal. Risk-based management for the identification and treatment of individuals at high risk for CVD and stroke events has been outlined by the WHO in its package of essential interventions for NCDs in low-resource settings. Strategies include non—laboratory-based CVD risk assessment, simplified treatment protocols based on drugs listed in the WHO Model List of Essential Medicines, regular audits of the adequacy of human resources, availability of equipment and laboratory reagents, adherence to clinical protocols, and maintenance of stock registers. Performance

TABLE 3. Cost-effective population-level strategies to achieve targets

WHO Risk Factor Targets and 25 by 25 Goals	Strategies for Population-Wide Intervention
Tobacco	
A 30% relative reduction in prevalence of current tobacco use in individuals ≥15 y of age	Higher taxes on tobacco products to reduce use and to fund tobacco control programs [18,20] Smoke-free indoor workplaces, public places, and public transportation [18,20,21] Mass-media campaigns about the danger of tobacco and tobacco smoke, including cigarette package warnings, especially those that are graphic and health related [18,20] Complete bans on all forms of advertising, promotion, and sponsorship of tobacco products [18,20]
High BP and sodium reduction	
A 25% relative reduction in the prevalence of raised BP or contain the prevalence of raised BP, according to national circumstances A 30% relative reduction in mean population intake of salt/sodium intake	Government policies to reduce sodium in packaged foods [22,23] Mass-media campaigns and voluntary action by food industry to reduce sodium consumption [24] Implementation of public awareness programs on diet and physical activity [25] Drug therapy (including glycemic control for DM and control of raised BP with a total risk approach) and counseling to individuals who have had a heart attack or stroke and to those at high risk (≥30%) of a fatal and nonfatal cardiovascular event in the next 10 y [25]
Unhealthy diet and physical inactivity	
Halt the rise in DM and obesity A 10% relative reduction in prevalence of insufficient physical activity	Replacement of *trans* fats with unsaturated fats [25] Implementation of public awareness programs on diet and physical activity [25] Fiscal methods that increase the price of foods high in saturated and industrially produced *trans* fats and sugar; food labeling; and marketing restrictions of unhealthy food products, especially to children and young people [26] Restriction of advertising to children [25] Drug therapy (including glycemic control for DM and control of raised BP with a total risk approach) and counseling to individuals who have had a heart attack or stroke and to those at high risk (≥30%) of a fatal and nonfatal cardiovascular event in the next 10 y [25]

Population-wide interventions must be considered to affect progress toward the modifiable risk factor targets. BP indicates blood pressure blood pressure; DM, diabetes mellitus; and WHO, World Health Organization.

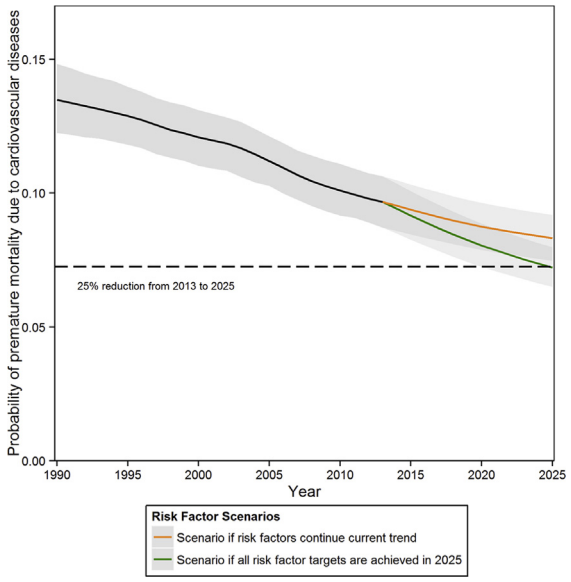

FIGURE 9. Probability of premature death resulting from cardiovascular disease in women between 30 and 70 years of age in North Africa/Middle East.

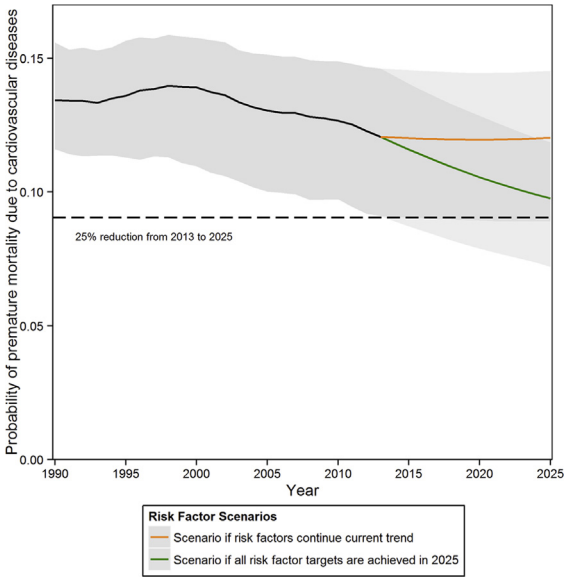

FIGURE 11. Probability of premature death resulting from cardiovascular disease in women between 30 and 70 years of age in South Asia.

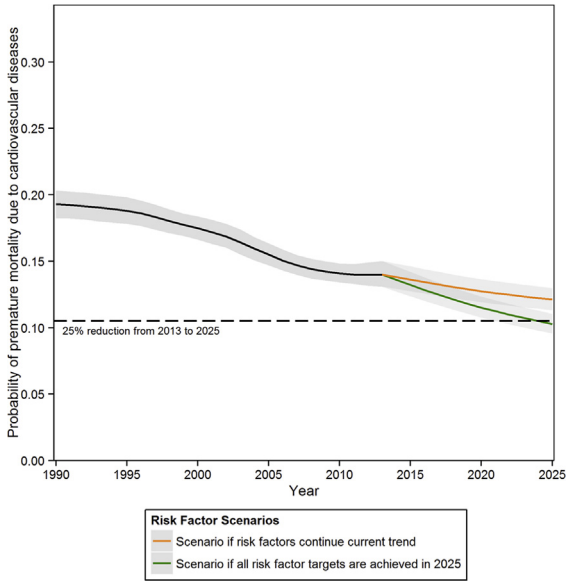

FIGURE 10. Probability of premature death resulting from cardiovascular disease in men between 30 and 70 years of age in North Africa/Middle East.

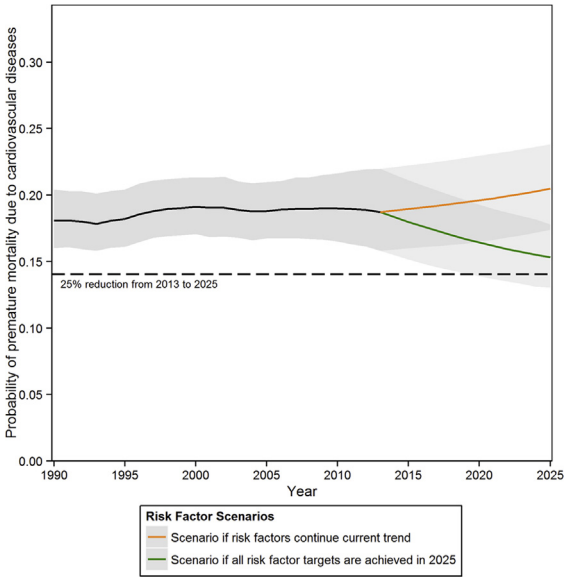

FIGURE 12. Probability of premature death resulting from cardiovascular disease in men between 30 and 70 years of age in South Asia.

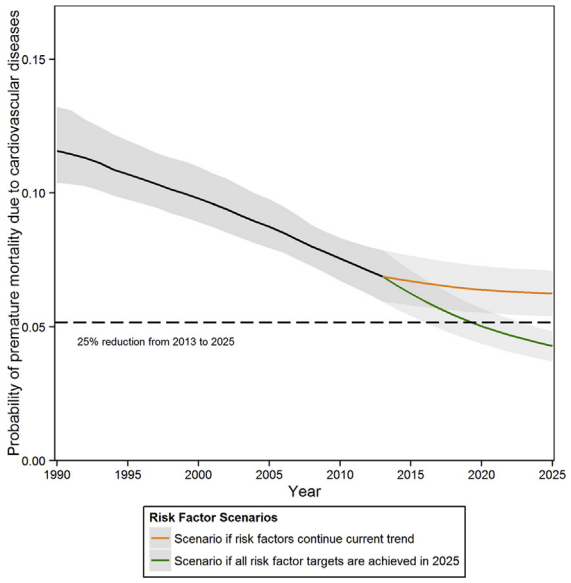

FIGURE 13. Probability of premature death resulting from cardiovascular disease in women between 30 and 70 years of age in East Asia/Pacific.

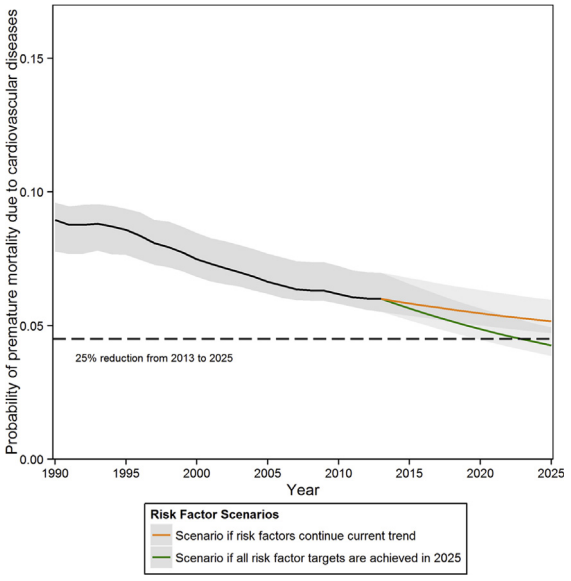

FIGURE 15. Probability of premature death resulting from cardiovascular disease in women between 30 and 70 years of age in Latin America/Caribbean.

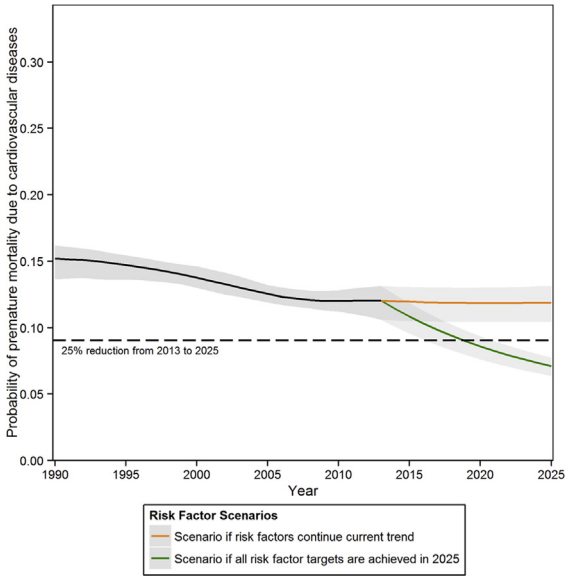

FIGURE 14. Probability of premature death resulting from cardiovascular disease in men between 30 and 70 years of age in East Asia/Pacific.

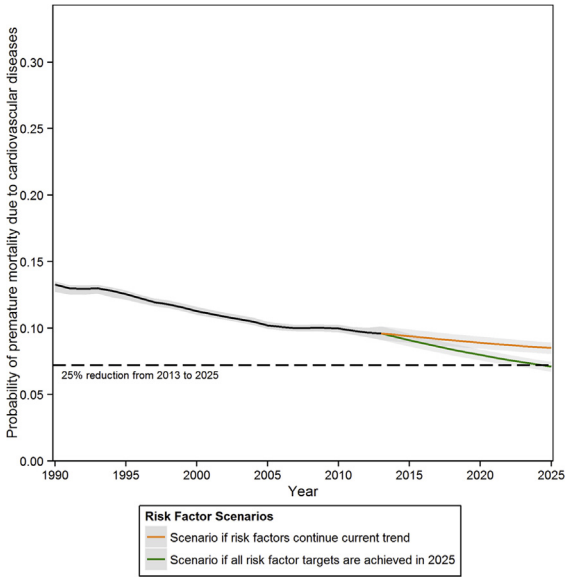

FIGURE 16. Probability of premature death resulting from cardiovascular disease in men between 30 and 70 years of age in Latin America/Caribbean.

assessments show that implementation of the total-risk approach in primary health care can lead to significant improvements in BP and DM control and to reductions in cardiovascular risk. In collaboration with ministries of health, the WHO has initiated similar projects in primary care in ≈30 resource-constrained settings [19].

Strengths and limitations

The data and results from the GDB 2013 study that were used provide the most robust estimates to date of the global and regional burden of cause-specific mortality and risk factor prevalence. Mortality data from 1990 through 2013, as well as modeled estimates of risk factor exposure, were used to create these projections. However, this analysis has limitations.

First, the regional figures appear to have an inflection point present at 2014. The prediction of future mortality begins in the year 2014 because mortality data were available only through 2013 at the time of the analysis. In our time-series figures, we have elected to show both estimates of mortality from 1990 to 2013 and the results of our model. This inflection point reflects the fact that, for the purpose of comparison, we are showing results of the GBD 2013 study (in black) and results of our projection model (in colors) within the same figure.

Second, the projections reflect counterfactual scenarios based on the theoretical minimum risk assumed for each risk factor rather than the effect of specific interventions. Therefore, these estimates reflect the combined impact of prevention and treatment, rather than being limited to treatment of individuals already at elevated risk. This assumption reflects the fact that both prevention and medical care will play an essential part in reducing the burden of CVD.

Third, we created models for risk factor targets that were limited to those agreed on by United Nations member states in 2013 and those for which there were sufficient global data on exposure levels.

Fourth, we restricted these analyses to reductions in premature CVD and stroke deaths. Other NCD goals, including reductions in cancer, DM, and respiratory diseases, were not estimated but are also essential to achieving the overall NCD goal.

Fifth, although joint effects were accounted for in the scenario in which all targets are met, for the BMI scenario only, the direct effect of BMI was estimated on mortality, separate from its effects through BP and fasting plasma glucose. The inclusion of all the downstream effects of high BMI would have shown this strategy to have an even larger impact. Because of this decision, however, the combined risk factor scenario was able to correctly account for the joint effects of the selected risk factors without overestimating the benefit of intervening on multiple metabolic risk factors.

CONCLUSIONS

By 2025, >5 million premature deaths from CVD among men and 2.8 million among women are projected worldwide. Estimates of the number of people with premature death from CVD and the probability of dying in 2025 vary across the globe. These data demonstrate wide variation in estimated future trends in risk factor prevalence and premature CVD mortality that will require region- and country-specific priority setting to achieve the 25 by 25 goal. Cost-effective population-wide intervention strategies exist to reduce BP, tobacco use, obesity, and DM but have not been widely implemented. Aggressive strategies to achieve multiple WHO targets, especially for raised BP and tobacco control, will be required to meet the 25 by 25 overall goal. Success is possible if the individual WHO targets are met and healthcare systems are strengthened. Achieving these goals can be accomplished only if countries and regions set priorities, implement cost-effective population-wide strategies, and collaborate in public-private partnerships across multiple sectors.

ACKNOWLEDGMENTS

We thank American Heart Association staff members Diana Vaca McGhie and Melanie B. Turner, MPH, for their contributions to the organization of the writing group and the development of this manuscript.

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DISCLOSURES

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*Modest.

†Significant.

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