

**Title:** Global Dietary Quality and Preventable Premature Death

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## **Abstract**

**Background** Although dietary intakes in different countries and regions have been previously reported, the premature mortality attributable to an improvement in overall dietary quality at a global level has not been documented.

**Methods** We applied the Alternate Healthy Eating Index (AHEI, potential range 0-100) to the dietary database of the Global Burden of Disease Study 2017 to assess the dietary quality among adults aged 25 years or older in 190 countries/ territories. The biological effects of dietary quality, i.e., risk ratios per unit of AHEI on the risk of major chronic disease, were estimated from two large cohorts of men and women with many repeated dietary assessments during up to 30 years. We then calculated the population-attributable fraction and potentially preventable deaths attributable to shifting from current national diets to a reference healthy diet.

**Findings** The global means of the AHEI in 2017 were 49.5 for male adults and 50.5 for female adults out of a maximum score of 100. We found large differences between current and target intakes for whole grains, sodium, long-chain n-3 polyunsaturated fatty acids, total polyunsaturated fatty acids, and fruit. From 1990 to 2017, the global mean AHEI increased modestly from 45.4 to 50.0. Diet quality varied substantially across 190 countries/ territories. The coastal countries/ territories around the Mediterranean Sea and those in the Caribbean region, and Eastern Asia (except China and Mongolia) had a higher AHEI, whereas the countries/ territories in Central Asia, South Pacific region, Eastern and Northern Europe had a lower AHEI. An improvement in dietary quality from the current global diet to the reference healthy diet would prevent more than 11 million deaths, accounting for 23.6% of total deaths in 2017.

**Interpretation** The global quality of diet was far from optimal and varied across different countries/ territories. Improvements in dietary quality have the potential to reduce mortality rates substantially.

**Key Words:** Diet; Chronic disease; Global health; Mortality

## Background

Adopting a healthy dietary pattern reduces morbidity and mortality from major chronic disease [1, 2]. Several reports from the Global Burden of Disease (GBD) Study ranked unhealthful diet among the top contributors to the burden of disease and death in the US [3] and globally [4]. However, these reports aggregated the disease burden associated with multiple individual dietary factors, essentially assuming independent contributions of each dietary factor and specific diseases, thus not accounting for the complex relationships among subcomponents of diet or the effects of all dietary factors on all diseases. An alternative, complementary approach to evaluate the overall healthfulness of a diet and account for the complex interrelationships among individual dietary components is to calculate a score or an index summarizing an individual's adherence to multiple predefined dietary criteria [5]. We developed the Alternate Healthy Eating Index (AHEI) in 2002 and updated it in 2010 using the best available evidence on diet and health [6]. The AHEI comprises key components of healthful diets, including higher consumption of plant sources of fats, fish, nuts and legumes, whole grains, fruit, and vegetables and low consumption of partially hydrogenated fat, red meat, and sugar-sweetened beverages and sodium. Previous studies have validated the AHEI as a strong predictor of major chronic disease [6-8], mortality [2, 9], and biomarkers of major chronic disease [10]. In our previous work, we used the AHEI to evaluate dietary quality in the US and found a modest improvement from 1999 through 2010 based on dietary data from the National Health and Nutrition Examination Survey [11]. At the global level, Imamura et al applied two similar dietary scores to evaluate dietary quality and their time trends nationally and regionally [12].

A key input in the calculation of disease burden attributable to a dietary factor is the biological effect, e.g., multivariable-adjusted risk ratio (RR) of a health outcome, for the specific dietary factor. The GBD study derived the biological effects through meta-analyses of observational cohort studies and a few dietary trials [3, 4, 13]. However, a majority of the studies included in the meta-analyses were limited by one or more methodological issues, such as single dietary measurement at baseline, lack of assessment of usual dietary intake, a short follow-up period, or insufficient statistical adjustment for potentially confounding variables. Therefore, the meta-analysis-based approach is likely to underestimate the biological effects of dietary factors. In addition, the meta-analyses usually estimated the biological effect of diet related to several well-studied disease endpoints, such as cardiovascular disease and type 2

diabetes [14]. However, recent studies have identified the relationships between diet and additional chronic diseases, such as respiratory and neurodegenerative diseases [15-19]. By applying the RRs of major chronic disease, total and cause-specific mortality per unit increase of the AHEI from the Nurses' Health Study (NHS) [20] and the Health Professionals Follow-Up Study (HPFS) [21], we previously quantified the reduction in disease burden associated with the improvement in dietary quality from 1999 to 2012 and estimated that the 8.3-point increase in the AHEI has prevented 1.1 million premature deaths in the US [22]. These estimates of the biological effects of dietary quality in the NHS and the HPFS are likely to represent particularly valid evidence on the relationship between long-term dietary intake and health outcomes because of the unique features of these cohorts, including extensively validated questionnaires for measuring usual dietary intake, many repeated and detailed measurements of diet and covariates, a continuously updated food composition database that accounts for changes in food processing including partial hydrogenation of plant oils, follow-up for over three decades, and large sample size [23]. Confounding is likely to be better controlled in the two cohorts than in most studies because of the use of repeated measures of potentially confounding variables and the relatively homogenous socioeconomic status of the study populations. The large number of cause-specific deaths (33,903 total deaths) accrued in the NHS and the HPFS enable the estimation of the biological effects of diet on mortality due to several important chronic diseases that were not analyzed in the GBD project, including neurodegenerative, respiratory, kidney, and digestive diseases.

Although the quality of diet in different countries and regions has been previously reported [12, 24], the disease burden attributable to a potential improvement in dietary quality at a global level has only been analyzed based on specific dietary factors [25-27], but not based on adherence to dietary indices that summarize overall healthfulness of diet. We therefore applied the biological effects of dietary quality estimated from the NHS and the HPFS to quantify the potential global impact of improving dietary quality on population health.

## **Methods**

### Alternate Healthy Eating Index and reference healthy diet

We applied the AHEI to assess the dietary quality in different countries/ territories around the world. For this study, we included 10 out of 11 components of the original AHEI (alcohol intake was excluded): fruits, vegetables, nuts and legumes, whole grains,

red/processed meat, sugar sweetened beverages, polyunsaturated fatty acids (PUFAs, predominantly n-6 PUFAs), long-chain n-3 PUFAs (mainly from seafood), *trans* fat, and sodium. The 10-dimensional AHEI ranged from 0 (non-adherence) to 100 (perfect-adherence); each of the components was scored from 0 to 10 (**Supplemental Table 1**). For fruits, vegetables, whole grains, nuts and legumes, long-chain n-3 PUFAs, and PUFAs, a higher score indicated higher intake. For *trans* fat, sugar-sweetened beverages, red/processed meat, and sodium, a higher score indicated lower intake. A reference healthy diet, modified slightly to align with available dietary data, from the EAT-Lancet Commission Report [28] was used as the target dietary pattern (**Table 1**). We also scored the reference healthy diet based on the AHEI criteria.

#### Global Dietary Database

We used data from the GBD 2017 as input in the calculation of AHEI scores for 190 countries/ territories in 1990 and 2017. The GBD 2017 compiled dietary data from multiple sources including nationally and sub-nationally representative nutrition surveys, household budget surveys, accounts of national sales, and United Nations Food and Agriculture Organization (FAO) Food Balance Sheets and Supply and Utilization Accounts. For the estimation of *trans* fat intake, the GBD 2017 additionally used data on availability of hydrogenated vegetable oil in packaged foods. The estimated sodium intake incorporated data of urinary sodium excretion from studies with 24-hour urine collections. Because we aimed to estimate preventable deaths due to major chronic disease, we restricted the analysis to adults aged 25 years or older. The detailed methods for identification of data sources, and data extraction and analysis in the GBD study can be found elsewhere [29].

#### Biological effects of dietary quality

We estimated the biological effects of dietary quality, i.e., multivariable-adjusted sex-specific RRs per 10 units of AHEI on the risk of major chronic diseases (including cancer, coronary heart disease, stroke, type 2 diabetes, respiratory, neurodegenerative, kidney and digestive system diseases, and other causes except injury and infection), as well as total mortality (excluding deaths due to injury and infection) from the NHS [20] and the HPFS [21]. We included both fatal and nonfatal outcomes for type 2 diabetes, coronary heart disease and stroke to improve statistical precision and minimize reverse causation; for the other causes of death we used only mortality data. For this analysis, we assumed no biological effects of dietary

quality on mortality due to injury and infection, because the types of infectious disease vary greatly across countries/ territories. The NHS is a prospective cohort study of 121,700 registered female nurses aged 30 to 55 years in 1976. The HPFS is a prospective cohort of 51,529 male health professionals aged 40 to 75 years in 1986. The baseline of this analysis was defined as 1984 for the NHS and 1986 for the HPFS. The two cohorts have been followed via biennial mailed questionnaires that inquire about lifestyle risk factors and other exposures of interest, as well as newly diagnosed diseases and are confirmed by obtaining further data [30]. The cumulative follow-up of the two cohorts exceeds 90% of potential person-time. We excluded participants who had a history of diabetes, coronary heart disease, stroke or cancer, or reported implausible dietary data (total energy intake <800 or >4200 kcal/day for men and <600 or >3500 kcal/day for women) at baseline. After exclusions, the analytical population consisted of 83,349 women and 40,741 men. Dietary information was collected with validated semi-quantitative food frequency questionnaires (SFFQs) [31]. Nutrient values were calculated based on the Harvard University Food Composition Database, which is updated every four years [32]. For this study, we used dietary information collected in 1984, 1986, and then every four years for a total of eight times in the NHS. In the HPFS, dietary information was first collected in 1986 and then every 4 years for a total of seven times. The end of follow-up was defined as June 2014 for the NHS and December 2014 for the HPFS.

#### Global Mortality data

We used a mortality database from the GBD 2017 to calculate preventable deaths in each country/ territory. The GBD mortality database was compiled based on multiple data sources, including vital registration data, subnational verbal autopsy studies, and surveys and surveillance systems for specific causes. The database contained data for 264 causes of death by sex for 23 age groups in 195 countries/ territories in 2017 as described previously [33, 34]. Based on the International Classification of Diseases (ICD)-9, we grouped the causes of death into ten major categories of causes, including cancer, coronary heart disease, stroke, respiratory disease, neurodegenerative disease, kidney disease, diabetes, digestive system disease, injury and infection. The remaining causes of deaths were grouped into an 'other causes' category.

#### Statistical analysis

We first applied the AHEI scoring criteria to the dietary database in the GBD 2017 to calculate the sex-specific mean AHEI and its component scores in each country/ territory. We then calculated the global mean score as an average of national AHEI scores in 1990 and in 2017, weighted by the population statistics in the corresponding year [33, 34]. In the NHS and the HPFS, the AHEI was calculated as cumulative average up to the start of each two-year follow-up interval to best represent long-term dietary intake and dampen within-person variation. Person-years of follow-up were calculated from baseline to the earliest of time of death, loss to follow-up or the end of follow-up. We applied Cox proportional hazards models that included AHEI as an exposure variable and cause-specific incidence and mortality as outcomes, and simultaneously adjusted for potentially confounding variables (including age, total energy intake, ethnicity, marital status, physical activity level, smoking status, alcohol consumption, multivitamin use, current aspirin use, family histories of myocardial infarction, diabetes and cancer, baseline histories of hypertension and hypercholesterolemia, and menopausal status and hormone use in women) to calculate the RRs (**Supplemental Table 2**). Because smoking is a strong confounding factor for the association between AHEI and respiratory disease mortality, we estimated the RRs on respiratory disease mortality among noncurrent smokers only to minimize residual confounding due to smoking. We also calculated the RRs with further adjustment for body mass index (BMI), which could be considered as a mediating rather than a confounding variable.

We calculated the population-attributable fraction (PAF) due to a potential improvement from the diets in different countries/ territories in 2017 to the reference healthy diet using the comparative risk assessment framework [35]. The calculation of cause-specific PAF incorporated the sex-specific distribution of AHEI in each country/ territory and the estimated biological effects of AHEI. The numbers of cause-specific deaths attributable to the potential improvement in dietary quality were calculated by multiplying the cause-specific PAF by the number of deaths due to that cause in each country/ territory. We calculated the numbers of total preventable deaths in each country/ territory in two ways. First, we summed up the preventable deaths across the 11 major categories of causes of death in each country/ territory to derive the numbers of total preventable deaths. The first way for calculating total preventable deaths accounted for the heterogeneity in distributions in causes of death across countries/ territories. Second, we applied the sex-specific RRs for total death (deaths due to injury and infection excluded) to calculate the PAF in a country/ territory, and then calculated

the numbers of preventable total deaths by multiplying the PAF by the number of total deaths (deaths due to injury and infection excluded) in that country/ territory. The preventable total and cause-specific deaths at a global level were calculated by summing up the deaths across different countries/ territories. The PAFs for total mortality in each country/ territory and globally were then calculated as the percentage of preventable total deaths in total deaths. In a sensitivity analysis, we conducted the same calculations of PAF and preventable deaths by using the RRs with additional adjustment for BMI. To calculate the uncertainty of the PAF, we used Monte Carlo simulations to take 1,000 draws from the distribution of AHEI and the RRs of AHEI simultaneously, propagating the uncertainty in dietary data and estimated biological effects of AHEI into the final estimates [14, 36]. All the analyses were conducted with SAS version 9.4 (SAS Institute, Cary, NC) and R software version 3.5.0 (R Foundation for Statistical Computing).

## Results

### Global dietary quality

In 2017, the global means of AHEI were 49.5 for male adults and 50.5 for female adults out of a maximum score of 100 (**Table 1**). Compared to other components of AHEI, low component scores (of 10 maximal) were seen for whole grains (AHEI =1.3), sodium (AHEI =1.8), long-chain n-3 PUFAs (AHEI =2.2), PUFAs (AHEI =2.8) and fruit (AHEI =3.6), suggesting large differences between current intake and optimal level. The modified reference healthy diet was scored 94.0 based on the AHEI criteria. From 1990 to 2017, the global mean of AHEI increased modestly from 45.4 in 1990 to 50.0 in 2017. This improvement was largely due to increased consumption of fruit and vegetables, long-chain n-3 PUFAs and total PUFAs, as well as decreased intake of *trans* fat. **Figure 1** shows substantial geographic variation in diet quality across 190 countries/ territories in 2017. Bermuda (AHEI =67.9), Dominican Republic (AHEI =66.6), Israel (AHEI =65.8), Taiwan Province of China (AHEI =65.6), Cuba (AHEI =64.8), and Iran (AHEI =63.0) were among the countries/ territories with the high AHEI (**Supplemental Table 3**). The coastal countries/ territories around the Mediterranean Sea and those in the Caribbean region, and Eastern Asia (except China and Mongolia) had generally higher AHEI scores (**Figure 1**), which was mainly attributed to their diets high in vegetables and nuts/legumes, but low in red/processed meat and sugar-sweetened beverages. Higher fruit consumption was another feature of the healthy diets in the Caribbean region (**Supplemental Table 3**). Several low- and middle-income (LMI) economies, such as Haiti, Rwanda and Uganda, had with relatively high AHEI scores. Low



consumption of unhealthy components of AHEI, including red/ processed meat, sugar-sweetened beverages and *trans* fat, rather than high consumption of healthy dietary components, contributed substantially to the high dietary quality in these LMI countries/ territories. The lowest AHEI scores were observed in Mongolia (AHEI =34.0), Afghanistan (AHEI =39.5), Czech Republic (AHEI =40.2), Georgia (AHEI =40.5), and Pakistan (AHEI =40.8). The countries/ territories in Central Asia, South Pacific region, Eastern and Northern Europe had very low consumptions of fruit, whole grains, nuts/legumes, PUFAs and long-chain n-3 PUFAs, and very high sodium intake, were rated among those with lowest AHEI. Most countries/ territories showed improvements in dietary quality from 1990 to 2010 (**Supplemental Figures 1 & 2**). In addition to several countries/ territories in Africa and South Pacific region, several Mediterranean countries/ territories, including Cyprus, Italy, Malta, and Portugal, were among those with decreases in the AHEI over time. These decreases in AHEI were largely driven by reduced consumption of fruits, nuts and legumes, and increased consumption of sodium (**Supplemental Tables 3 and 4**).

#### Potentially preventable deaths attributable to improvement in dietary quality

We calculated that improvements in dietary quality from current diet to the reference healthy diet would prevent 11,593,279 premature deaths in one year, accounting for 23.6% of total deaths in 2017 (**Table 2**). Estimated reductions in deaths at country/ territory-level are shown in **Supplemental Table 5**. The potential improvement in dietary quality would lead to 22.8% fewer deaths in men and 24.6% fewer deaths in women. When we applied the RRs for total death (deaths due to injury and infection excluded) to the estimation of PAF instead of using the RRs for cause-specific mortality or incident chronic diseases, the PAF for total mortality (25.5%) and total preventable deaths (12,489,883) were similar. Coronary heart disease accounted for the largest number of preventable deaths; about two million fewer deaths in men and about 1.9 million fewer deaths in women. About one in three deaths due to coronary heart disease (PAF =35.8%) would be prevented by the increase in AHEI globally. The improvement in dietary quality would prevent about one in six deaths due to cancer (PAF =16.4%) and stroke (PAF =17.1%). The improvement in dietary quality was responsible for a large number of deaths due to respiratory disease; about one million preventable deaths in women and 0.7 million in men. In the sensitivity analysis that applied the RRs of AHEI with further adjustment for BMI, the

estimated PAFs and preventable deaths were similar to those in the main analysis (Supplemental Table 6).

## Discussion

We evaluated the quality of diet in 190 countries/ territories by applying the AHEI, a dietary quality score summarizing ten key components of healthy eating, to the most updated global dietary database. The global dietary quality improved modestly from 1990 to 2017, at which time it remained far from optimal. We observed substantial variation in dietary quality across the 190 countries/ territories. In our modeling analysis, a potential improvement in dietary quality from current national diets to a healthy reference diet would prevent more than 11 million premature deaths annually, accounting for about one fourth of total deaths among adults worldwide in 2017.

Our finding that dietary quality varied substantially across countries/ territories corroborates Imamura et al.'s data in 187 countries/ territories [12] and the report from the Prospective Urban Rural Epidemiology (PURE) Study in 17 countries [24]. Dietary quality in different countries and regions is determined by a matrix of interrelated factors at local levels, including traditional food patterns, local food availability, industrialization of food supply system and food and agricultural policies. Although originally developed in a US population, the AHEI has predicted health outcomes in many countries and regions and showed its ability to capture dietary patterns in geographically and socioeconomically diverse populations around the world [7, 8]. The AHEI rated many coastal countries around the Mediterranean Sea, such as Turkey, Lebanon, and Morocco, as those with the highest dietary quality. Populations in this region consume dietary patterns influenced by the traditional Mediterranean diet [37], even though modern industrialized diets have modified the traditional dietary patterns in this region [38], as indicated the declines in diet quality in Italy and Portugal and other countries between 1990 and 2017. The healthfulness of the Mediterranean diet was first proposed by Keys and colleagues because populations in the Mediterranean region had remarkably longest life expectancy and low rates of many chronic diseases, such as coronary heart disease and certain cancers despite their limited access to medical services [39]. Subsequent prospective cohort studies [40-43] and randomized controlled trials [44, 45] provided strong evidence supporting these benefits of the Mediterranean diet. Several LMI countries were also among those with the highest AHEI, which may be explained by both their traditional eating habits and less industrialized food supply

system. For example, the high dietary quality in several LMI African countries, such as Uganda and Rwanda, was partly contributed by their high legume consumption, which was in accordance with their traditional diets [29]. In addition, these countries/ territories with high dietary quality had very low consumption of sugary beverages and *trans* fat, suggesting limited access to processed foods and less industrialized food systems in these countries. This finding was consistent with Imamura et al.'s report of an inverse association between income level and an index scoring the intakes of unhealthy dietary factors, including sugar-sweetened beverages, red/ processed meat, *trans* fat, saturated fat, sodium and cholesterol, in 187 countries/ territories [12]. Although these LMI countries have low rates of chronic diseases, some still have high rates of undernutrition in children, presenting a challenge to address the latter while still retaining the positive aspects of traditional diets. Despite their high sodium intake, several Eastern Asian countries/ territories, including Taiwan Province of China, Japan and Republic of Korea, were rated as those with high AHEI, suggesting their successes in preserving their traditional diets high in vegetables, nuts/ legumes and PUFAs from either vegetable oil or fish and low in red/ processed meat, as well as nutrition education efforts [46-49]. The high AHEI in the Democratic People's Republic of Korea may partially reflect sustained shortage of food, particularly animal-sourced foods, during the past decades [50] as indicated by low consumption of red/ processed meat and long-chain n-3 PUFAs. As the most populous country in Eastern Asia, China was not among those with a high AHEI. Compared to Japan and Republic of Korea, China had higher consumption of red/ processed meat, lower consumptions of nuts/ legumes and PUFAs, which was consistent with a previous report that China has experienced a dramatic shift in dietary patterns, from a traditional diet high in plant-based foods to a Westernized diet since the early 1980s' [51]. In addition, sodium intake, largely from added condiments, in China remained the highest in Eastern Asia [52, 53]. Besides their low consumptions of plant-sourced foods and vegetable oils and high consumption of red meat, very high consumption of sugar-sweetened beverage was a major contributor to the low dietary quality in several countries/ territories in Scandinavian region, Eastern Europe (e.g., Czech Republic and Poland), Chile and Argentina, which was consistent with previous findings from cross-nation comparison studies on sugar-sweetened beverages [54, 55]. Of note, Canada and the US, and many countries/ territories in Latin American region also showed very high intake of sugary beverages in addition to their high sodium intake and low plant-sourced foods in 2017. The dietary patterns in this region were characterized by a wide variety of processed and low-nutrient-density foods and

sugar-sweetened beverages produced by food supply systems that comprised supermarkets, large food processors and fast food chains [56-58]. The food availability and traditional dietary habits in several countries/ territories in Central Asia, such as Mongolia, Turkmenistan and Afghanistan, were largely responsible for their low dietary quality, characterized by very low consumption of fruit and vegetable, legumes, nuts and whole grains, as well as high sodium intake. The extreme continental climate in these countries/ territories have shaped a traditional diet where red meat and dairy products were the main sources of energy with limited access to fresh plant-sourced foods [59]. Political factors, such as domestic and international conflicts, and economic crisis also had influence on food production and trade [60], and may be responsible for the worsening dietary quality over time in the countries/ territories such as Cyprus and Lebanon.

Our study has several strengths. First, we calculated the dietary quality based on the most updated and comprehensive global dietary database from the GBD Study. Although these data are inevitably imperfect, they do describe a global pattern that is consistent with other knowledge. Second, the biological effects of dietary quality estimated from the NHS and the HPFS have unique advantages because of the extensive dietary assessment and ability to control potentially confounding factors. Lastly, our study expanded calculations on preventable deaths to traditionally under-studied causes, such as respiratory disease and chronic kidney disease, providing a more comprehensive estimation of disease burden attributable to poor dietary quality.

Our findings should be interpreted in the context of several limitations. First, individual-level self-reported survey data in the GBD Study were subject to measurement errors and incomplete for some regions and dietary factors. Also, the dietary assessments used to estimate the biological effects were uniquely comprehensive, but still inevitably incorporate some measurement error. However, such errors would tend to underestimate the strengths of biological effects. Second, we cannot rule out the possibility of residual confounding when estimating the biological effects of dietary quality in the observational cohort studies. However, residual confounding is likely to be minimized as we have carefully adjusted for multiple potential confounding variables. Third, some participants may have changed their dietary behaviors, e.g., increasing fruit and vegetable intake, upon diagnosis of intermediate diseases or conditions during the extended follow-up of the NHS and the HPFS, which may underestimate PAFs and preventable deaths. Fourth, the study populations in the NHS and HPFS were

homogeneous in education and occupation, and about 94% were of European background. The limited diversity, while minimizing confounding, might limit the generalizability of our estimates of the biological effects of diet. However, there is little evidence that the biological effects of diet differ qualitatively across racial or ethnic groups, even though the distribution of dietary factors differ greatly. Although the context was that of an industrialized, affluent population, this is increasingly the context of the food systems of most countries/ territories. Lastly, our disease burden calculations assumed that the health effects of diet occur relatively rapidly, and we did not apply age-specific effects of diet. Thus, the estimated preventable deaths would be a conservative estimation. Also, because the global burden of disease is shifting from infectious diseases to chronic diseases, the proportion of deaths preventable by improved diet quality should increase. Although we assumed no effect of dietary quality on mortality due to infectious disease, some benefits are likely [61, 62].

To our knowledge, this study is the first analysis of the potential reductions in mortality rates potentially achievable by improvement in overall dietary quality at a global level. The substantial reductions in premature deaths, about one fourth of total deaths globally, provide strong justification for prioritizing healthy diets in the global agenda and governmental policymaking for the prevention of chronic disease. ([Comparisons with Afshin et al. to be added](#)) Various strategic documents from the World Health Organization (WHO) and the FAO, including the Rome Declaration on Nutrition [63], the Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013–2020 [64] and the Fiscal Policies for Diet and the Prevention of Noncommunicable Diseases [65], have recommended a set of policy options and strategies to promote healthy eating. These recommendations particularly encouraged countries to consider the use of legislative and economic tools aimed at changing the environment to foster and support consumers' healthy choices of food. At country level, the development and regular updates of dietary guidelines that incorporate the best available scientific evidence on diet and health would be the first and a fundamental step for further regulatory actions and nutrition education [66]. In addition, legislation, trade measures, taxes and subsidies are important means of creating incentives to promote behavioral changes and improve access to healthy dietary choices. The role of government actions in eliminating *trans* fats in the US and several other countries has set a successful precedent. In our previous study, we estimated that about half of the improvement in dietary quality from 1999 to 2012 was contributed by the gradual elimination of *trans* fat in the US food supply [22], which has already contributed to significant

reductions in the rate of cardiovascular disease [67]. Recently, the WHO released the REPLACE action package, providing countries and regions with actionable tools to accelerate the elimination of industrially-produced *trans* fats from the global food supply [68], which will lead to substantial reduction in disease burden. The role of government actions was also exemplified by the nation-level taxation on sugary beverages and low-nutrient-density foods pioneered by the Mexican government. After the implementation of a specific excise tax of approximately 10 % on sugary beverages and an *ad valorem* sales tax of 8 % on nonessential foods in 2014, Mexico has seen a 6% decrease in the purchases of taxed beverages [58] and a 5.1% decrease in the purchases of taxed foods [57] in one year. Lastly, it is critical to align agricultural policy with nutrition policy at global and country levels via an array of policy arrangements including economic incentives and regulatory actions [69]. The global agricultural system after the end of World War II has focused more on addressing hunger and the supply of basic starchy staples followed by animal-sourced foods and cash crops, such as sugar cane and palm oil. This system has not shifted as diet-related chronic diseases have become global epidemics and is incompatible with a food supply system designed to deliver an affordable and healthful diet. In addition, future policy initiatives need to simultaneously address nutrition and environmental sustainability. For example, the nutrition-guided agricultural policies should be developed within the boundaries of sustainability, while the dietary guidelines may also include recommendations to decrease environmental footprints by dietary changes and other measures [70].

In conclusion, the global quality of diet is far from the optimal level and varies greatly across countries/ territories. We estimate that a potential change from the national diets in 2017 to a reference healthy dietary would lead to a reduction of more than eleven million premature deaths annually. Given recent regulatory successes in addressing healthy eating, such as elimination of *trans* fat and taxation on sugary beverages, further policy initiatives and government actions are urgently needed to address additional components of healthy eating, which can be translated to substantial reductions in the burden of major chronic disease.

**Table 1.** Targets for the healthy reference diet and mean dietary intakes and the Alternate Healthy Eating Index in men and women aged 25 years or older in 190 countries/ territories in 2017 and 1990.<sup>1</sup>

	Reference Diet		2017						1990					
			Men		Women		Both sexes		Men		Women		Both sexes	
	Intake	AHEI	Intake	AHEI	Intake	AHEI	Intake	AHEI	Intake	AHEI	Intake	AHEI	Intake	AHEI
Vegetables (g/day)	300	9.2	197	5.9	183	5.5	190	5.7	134	4.1	125	3.8	129	3.9
Fruit (g/day)	200	7.7	87.0	3.3	99.5	3.8	93.4	3.6	58.2	2.2	68.1	2.6	63.2	2.4
Whole grains (g/day)	232	10.0	29.9	1.2	28.0	1.4	28.9	1.3	28.1	1.2	26.2	1.3	27.1	1.2
Sugar-sweetened beverage (g/day)	0	10.0	58.4	7.6	41.5	8.2	49.8	7.9	55.9	8.1	41.5	8.4	48.7	8.2
Nuts and legumes (g/day)	125	10.0	54.3	7.3	44.3	6.7	49.2	7.0	44.2	7.2	37.3	6.5	40.7	6.8
Red / processed meats (g/day)	14	9.1	36.6	7.6	24.3	8.4	30.4	8.0	32.6	7.8	22.7	8.5	27.6	8.2
<i>trans</i> Fat (% of energy)	0	10.0	0.4	9.7	0.5	9.5	0.5	9.6	0.6	9.3	0.7	9.0	0.7	9.2
Long-chain n-3 PUFAs (mg/day)	250	10.0	105.0	2.3	90.4	2.0	97.6	2.2	66.7	1.7	60.0	1.6	63.3	1.7
PUFAs (% of energy)	10.0	10.0	4.3	2.9	4.2	2.8	4.3	2.8	3.3	1.9	3.3	2.0	3.3	2.0
Sodium (mg/day)	2300	8.0	5792	1.7	5334	2.0	5560	1.8	5846	1.7	5731	1.8	5788	1.8
Total AHEI		94.0		49.5		50.5		50.0		45.3		45.6		45.4

Abbreviations: AHEI, Alternate Healthy Eating Index; PUFA, polyunsaturated fatty acid

**Table 2.** Percentage reductions in deaths as a result of improvements in the Alternate Healthy Eating Index from the current diet to the reference healthy diet in men and women aged 25 years or older in 190 countries/ territories in 2017. <sup>1</sup>

	Men	Women	Both sexes
<b>Total deaths <sup>2</sup></b>			
Preventable deaths	6,071,032 (2,412,523 - 8,965,512)	5,522,247 (2,360,919 - 8,017,118)	11,593,279 (4,773,442 - 16,982,629)
PAF (%)	22.8 (9.1, 33.7)	24.6 (10.5, 35.7)	23.6 (9.7, 34.6)
<b>Total deaths <sup>3</sup></b>			
Preventable deaths	6,369,653 (5,082,373 - 7,543,363)	6,120,230 (5,081,667 - 7,073,697)	12,489,883 (10,164,040 - 14,617,060)
PAF (%)	23.9 (19.1, 28.3)	27.3 (22.6, 31.5)	25.5 (20.7, 29.8)
<b>Cause-specific deaths</b>			
<b>Cancer</b>			
Preventable deaths	1,031,548 (333,972 - 1,641,670)	551,585 (79,850 - 970,589)	1,583,133 (413,822 - 2,612,260)
PAF (%)	18.3 (5.9, 29.1)	13.6 (2.0, 24.0)	16.4 (4.3, 27.0)
<b>Coronary heart disease</b>			
Preventable deaths	2,015,386 (1,408,313 - 2,542,409)	1,876,413 (1,237,383 - 2,417,194)	3,891,799 (2,645,697 - 4,959,603)
PAF (%)	34.7 (24.2, 43.8)	37.0 (24.4, 47.7)	35.8 (24.3, 45.6)
<b>Stroke</b>			
Preventable deaths	353,474 (-381,158 - 947,220)	685,945 (201,983 - 1,092,552)	1,039,420 (-179,176 - 2,039,772)
PAF (%)	11.3 (-12.1, 30.2)	23.1 (6.8, 36.8)	17.0 (-2.9, 33.4)
<b>Respiratory disease</b>			
Preventable deaths	710,420 (174,376 - 1,108,400)	958,753 (540,219 - 1,239,757)	1,669,173 (714,595 - 2,348,156)
PAF (%)	33.2 (8.1, 51.8)	55.5 (31.3, 71.7)	43.1 (18.5, 60.7)
<b>Neurodegenerative disease</b>			
Preventable deaths	361,334 (130,880 - 542,682)	34,642 (-380,672 - 382,265)	395,975 (-249,792 - 924,947)
PAF (%)	34.0 (12.3, 51.1)	1.9 (-21.2, 21.2)	13.8 (-8.7, 32.3)
<b>Kidney disease</b>			
Preventable deaths	247,448 (-47,308 - 429,402)	279,764 (-1,046 - 436,642)	527,212 (-48,354 - 866,044)
PAF (%)	39.1 (-7.5, 67.9)	49.7 (-0.2, 77.6)	44.1 (-4.0, 72.5)
<b>Diabetes</b>			
Preventable deaths	274,212 (206,259 - 332,458)	293,277 (239,950 - 340,646)	567,489 (446,209 - 673,104)
PAF (%)	42.0 (31.6, 51.0)	41.7 (34.1, 48.4)	41.8 (32.9, 49.6)
<b>Digestive system disease</b>			
Preventable deaths	790,088 (412,985 - 1,039,195)	455,382 (186,584 - 638,129)	1,245,471 (599,569 - 1,677,324)
PAF (%)	57.0 (29.8, 75.0)	50.2 (20.6, 70.3)	54.3 (26.2, 73.2)
<b>Injury (assumed)</b>			
Preventable deaths	0	0	0
PAF (%)	0	0	0
<b>Infection (assumed)</b>			



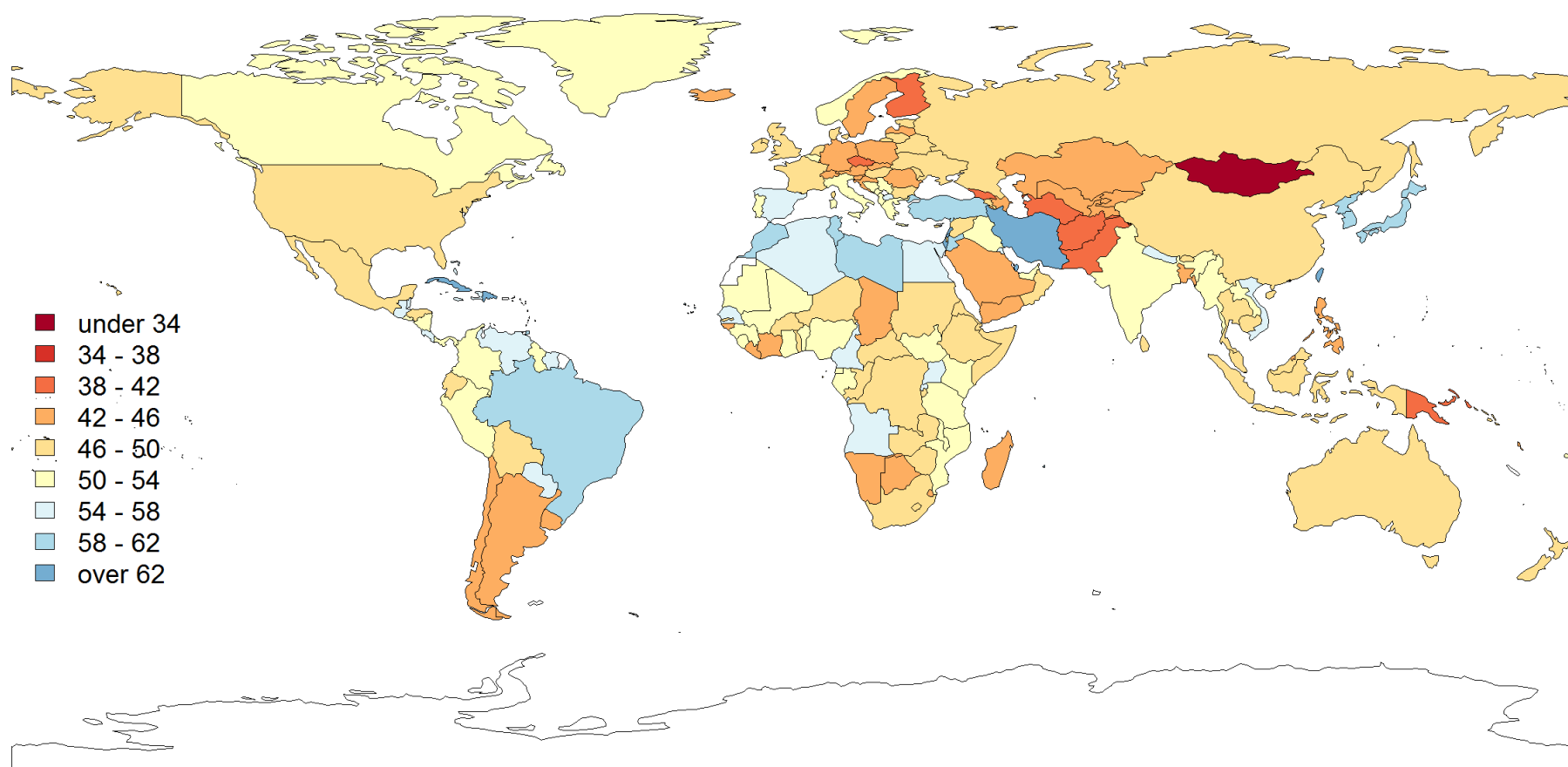
Preventable deaths	0	0	0
PAF (%)	0	0	0
<b>Other causes</b>			
Preventable deaths	287,123 (174,204 - 382,075)	386,486 (256,668 - 499,345)	673,608 (430,872 - 881,419)
PAF (%)	38.0 (23.0, 50.5)	35.1 (23.3, 45.4)	36.3 (23.2, 47.5)

Abbreviation: PAF, population attributable fraction.

<sup>1</sup> Values were population attributable fractions (95% confidence interval) calculated based on comparison in Alternate Healthy Eating Index between global diet in 2017 and the reference healthy Diet.

<sup>2</sup> Total preventable deaths were calculated by summing up all the preventable cause-specific deaths. PAFs were calculated as the percentage of preventable total deaths in total deaths, including those due to infection and injury in the denominator.

<sup>3</sup> PAFs for total mortality were calculated based on the biological effects (risk ratios) for total deaths (deaths due to injury and infection excluded) from the Nurses' Health Study and the Health Professionals Follow-Up Study. Preventable total deaths were calculated by multiplying the total deaths (deaths due to injury and infection excluded) by the PAFs. The final PAFs for total mortality were calculated as the percentage of preventable total deaths in total deaths, including those due to infection and injury in the denominator.



**Figure 1.** Geographical distribution of Alternate Healthy Eating Index in men and women aged 25 years or older in 190 countries/ territories in 2017. White areas indicate that dietary data were not available.

**Supplemental Table 1.** The Alternate Healthy Eating Index scoring method.

Component	Criteria for minimum score (0)	Criteria for maximum score (10)
Vegetables, <sup>1</sup> <i>servings/d</i>	0	≥5
Fruit, <sup>2</sup> <i>servings/d</i>	0	≥4
Whole grains, <sup>3</sup> <i>servings/d</i>	0	
Women		5
Men		6
Sugar-sweetened beverages and fruit juice, <sup>4</sup> <i>servings/d</i>	≥1	0
Nuts and legumes, <sup>5</sup> <i>servings/d</i>	0	≥1
Red/processed meat, <sup>6</sup> <i>servings/d</i>	≥1.5	0
<i>trans</i> Fat, % of energy	≥4	≤0.5
Long-chain (n-3) fats (EPA + DHA), <i>mg/d</i>	0	250
PUFA, % of energy	≤2	≥10
Sodium, <i>mg/d</i>	Highest decile	Lowest decile
Total	0	100

Abbreviations: DHA, docosahexaenoic acid; EPA, eicosapentaenoic acid; PUFA, polyunsaturated fatty acid.

<sup>1</sup> 1 serving of vegetables equals to 65 g

<sup>2</sup> 1 serving of fruit equals to 65 g

<sup>3</sup> 1 serving of whole grains equals to 40 g (1 cup cooked) of whole-grain cereal.

<sup>4</sup> 1 serving of sugar-sweetened beverage equals to 226.8 g (8 oz).

<sup>5</sup> 1 serving of nuts and legumes equals to 50 g of nuts/legumes/seeds

<sup>6</sup> 1 serving of red and/or processed meats equals to 100 g

**Supplemental Table 2.** Associations for a 10 unit increment of the Alternate Healthy Eating Index with cause-specific incidence and mortality in the Nurses' Health Study (1984-2014) and the Health Professionals Follow-Up Study (1986-2014).

	Male		Female	
	RR (95% CI) <sup>1</sup>	P-value	RR (95% CI)	P-value
<b>Total deaths (deaths due to injury and infection excluded)</b>				
Model 1 <sup>2</sup>	0.83 (0.82, 0.85)	<0.001	0.79 (0.77, 0.80)	<0.001
Model 2 <sup>3</sup>	0.92 (0.91, 0.94)	<0.001	0.91 (0.90, 0.93)	<0.001
Model 3 <sup>4</sup>	0.91 (0.90, 0.93)	<0.001	0.91 (0.90, 0.93)	<0.001
<b>Cancer mortality</b>				
Model 1	0.87 (0.85, 0.90)	<0.001	0.87 (0.84, 0.89)	<0.001
Model 2	0.96 (0.93, 0.99)	0.005	0.97 (0.94, 0.99)	0.017
Model 3	0.95 (0.92, 0.98)	<0.001	0.96 (0.94, 0.99)	0.014
<b>Incident coronary Heart disease</b>				
Model 1	0.86 (0.83, 0.88)	<0.001	0.81 (0.78, 0.84)	<0.001
Model 2	0.91 (0.88, 0.94)	<0.001	0.90 (0.86, 0.94)	<0.001
Model 3	0.92 (0.89, 0.95)	<0.001	0.90 (0.86, 0.94)	<0.001
<b>Incident stroke</b>				
Model 1	0.93 (0.88, 0.97)	0.002	0.88 (0.84, 0.91)	<0.001
Model 2	0.97 (0.92, 1.02)	0.29	0.94 (0.90, 0.98)	0.007
Model 3	0.98 (0.93, 1.03)	0.36	0.94 (0.90, 0.98)	0.007
<b>Respiratory disease mortality <sup>5</sup></b>				
Model 1	0.81 (0.76, 0.87)	<0.001	0.76 (0.69, 0.84)	<0.001
Model 2	0.91 (0.85, 0.98)	0.01	0.82 (0.74, 0.91)	<0.001
Model 3	0.87 (0.81, 0.94)	<0.001	0.82 (0.74, 0.91)	<0.001
<b>Neurodegenerative disease mortality</b>				
Model 1	0.82 (0.77, 0.88)	<0.001	0.82 (0.78, 0.86)	<0.001
Model 2	0.91 (0.85, 0.97)	0.004	0.99 (0.95, 1.05)	0.82
Model 3	0.88 (0.83, 0.94)	<0.001	0.99 (0.94, 1.04)	0.58
<b>Chronic kidney disease mortality</b>				
Model 1	0.83 (0.73, 0.95)	0.005	0.73 (0.62, 0.86)	<0.001
Model 2	0.88 (0.77, 1.01)	0.07	0.84 (0.70, 1.00)	0.04
Model 3	0.88 (0.77, 1.01)	0.06	0.84 (0.71, 1.00)	0.05
<b>Incident diabetes</b>				
Model 1	0.83 (0.81, 0.86)	<0.001	0.81 (0.79, 0.83)	<0.001
Model 2	0.88 (0.85, 0.92)	<0.001	0.88 (0.86, 0.91)	<0.001
Model 3	0.92 (0.88, 0.95)	<0.001	0.89 (0.86, 0.91)	<0.001
<b>Digestive system disease mortality</b>				
Model 1	0.71 (0.64, 0.80)	<0.001	0.72 (0.64, 0.80)	<0.001
Model 2	0.82 (0.73, 0.92)	<0.001	0.85 (0.75, 0.95)	0.004
Model 3	0.81 (0.73, 0.91)	<0.001	0.85 (0.76, 0.95)	0.004
<b>Mortality due to other causes except injury and infection</b>				
Model 1	0.81 (0.77, 0.85)	<0.001	0.75 (0.72, 0.78)	<0.001
Model 2	0.90 (0.85, 0.94)	<0.001	0.90 (0.87, 0.94)	<0.001
Model 3	0.89 (0.85, 0.93)	<0.001	0.90 (0.87, 0.94)	<0.001

Abbreviation: RR, risk ratio.

<sup>1</sup> Values are risk ratios (95% confidence interval) of incident disease/cause-specific mortality association with 10-unit increment in the Alternate Healthy Eating Index.

<sup>2</sup> Model 1 adjusted for age (in month).

<sup>3</sup> Model 2 further adjusted for total energy intake (quintiles), Caucasian (yes vs. no), marital status (with spouse, yes or no), moderate to vigorous physical activity (0, 0-1, 1.1-3.4, 3.5-5.9,  $\geq 6$  hours per week), smoking status (never, past,

current 1-14 cigarettes/d, current 15-24 cigarettes/d, current  $\geq 25$  cigarettes/d), alcohol consumption (women: 0, 0.1-4.9, 5.0-14.9,  $\geq 15$  g/d; men: 0, 0.1-4.9, 5.0-29.9,  $\geq 30$  g/d), multivitamin use (yes vs. no), current aspirin use (yes vs. no), family history of myocardial infarction (yes vs. no), family history of diabetes (yes vs. no), family history of cancer (yes vs. no), history of hypertension (yes vs. no), history of hypercholesterolemia (yes vs. no), and menopausal status and hormone use in women (premenopausal, postmenopausal never users, postmenopausal past users, postmenopausal current users).

<sup>4</sup> Model 3 further adjusted for body-mass index (<23, 23-24.9, 25-29.9, 30-34.9,  $\geq 35$  kg/m<sup>2</sup>).

<sup>5</sup> Risk ratios on respiratory disease mortality were estimated among nonsmokers only with adjustment for time since smoking cessation (never, 0-2, 3-9,  $\geq 10$  years)

**Supplemental Table 3.** Alternate Healthy Eating Index and its component scores in men and women aged 25 years or older in 190 countries/ territories in 2017.

Countries / Territories	AHEI	Vegetables	Fruit	Whole grains	Sugar sweetened beverages	Nuts / legumes	Red / processed meats	<i>trans</i> fat	Long-chain n-3 PUFAs (DHA + EPA)	PUFAs	Sodium
Bermuda	67.9	6.3	9.6	1.4	2.8	8.1	8.0	10.0	8.0	9.5	4.1
Dominican Republic	66.6	3.0	9.2	1.5	6.0	9.9	8.6	10.0	3.1	9.8	5.4
Israel	65.8	9.8	6.4	0.3	5.7	9.7	7.7	10.0	5.4	8.1	2.6
Taiwan, Province of China	65.6	7.9	6.0	1.1	8.1	10.0	6.7	10.0	2.9	10.0	2.9
Cuba	64.8	7.8	7.5	1.4	7.5	10.0	8.4	10.0	2.1	4.9	5.2
Iran, Islamic Republic of	63.0	10.0	6.9	0.1	7.5	9.9	9.3	8.2	2.2	6.7	2.1
Qatar	62.9	10.0	8.4	0.4	2.5	10.0	7.8	10.0	6.8	6.0	1.1
Lebanon	62.3	9.6	5.1	0.1	7.6	10.0	8.5	10.0	2.4	6.8	2.2
Japan	61.7	7.9	3.2	1.5	7.5	9.9	7.6	10.0	10.0	4.0	0.1
Turkey	61.2	10.0	6.8	0.1	7.3	10.0	9.2	10.0	2.2	1.5	4.1
Antigua and Barbuda	60.5	4.3	7.1	1.1	4.8	7.7	8.6	10.0	4.3	7.5	5.0
Morocco	60.3	7.9	5.7	0.1	9.0	9.7	9.2	9.9	1.9	4.2	2.6
Mauritius	60.1	4.5	2.8	1.1	7.8	10.0	9.1	10.0	3.6	10.0	1.2
Brazil	59.7	3.0	5.8	1.8	5.9	10.0	6.2	10.0	4.9	9.6	2.7
Tunisia	59.5	10.0	4.2	0.2	8.4	10.0	9.3	10.0	1.5	3.5	2.4
Korea, Republic of	59.3	7.6	5.4	2.1	7.6	7.7	7.1	9.6	2.4	9.1	0.7
Cape Verde	59.3	4.2	3.7	1.9	8.2	9.9	8.2	10.0	2.0	6.5	4.5
Korea, Democratic People's Republic of	59.0	7.0	2.5	1.8	9.8	10.0	9.6	10.0	0.4	6.4	1.5
Libyan Arab Jamahiriya	58.9	6.4	3.4	0.2	8.3	8.1	9.1	9.9	1.5	9.5	2.4
Jordan	58.6	7.4	2.7	0.1	8.2	9.5	9.1	9.9	2.9	6.5	2.3
Barbados	58.5	3.9	5.1	0.9	6.0	10.0	8.5	10.0	3.6	5.5	4.9
Bahrain	58.4	9.6	6.0	0.4	4.6	9.9	8.5	9.9	3.8	4.1	1.6
Trinidad and Tobago	58.1	2.0	4.1	0.6	3.8	9.9	8.9	10.0	4.2	9.8	5.0
Haiti	57.7	1.2	3.2	1.1	9.2	10.0	9.4	10.0	0.8	6.5	6.5
Paraguay	57.6	3.0	3.9	1.7	7.1	9.9	7.2	10.0	2.2	9.5	3.1
Guatemala	57.3	3.6	3.2	1.6	7.2	10.0	9.2	9.9	2.1	4.8	5.7
Grenada	57.2	3.5	5.6	1.0	6.6	7.5	8.8	10.0	3.1	6.2	5.0
Nepal	57.1	6.6	2.6	2.0	9.9	10.0	9.3	9.3	1.1	4.8	1.4
Saint Lucia	56.9	3.4	5.3	1.0	6.7	7.5	8.8	10.0	3.0	6.0	5.2
Rwanda	56.8	3.0	7.8	1.1	9.3	10.0	9.6	10.0	0.3	0.0	5.8
Kuwait	56.8	9.4	3.4	0.8	3.4	7.9	8.3	9.9	5.1	7.2	1.3
Dominica	56.6	3.3	5.2	1.0	7.2	7.4	8.8	10.0	2.8	5.8	5.2
Uganda	56.6	1.8	7.2	1.8	9.3	10.0	9.3	10.0	0.8	0.7	5.8

Saint Vincent and the Grenadines	56.6	3.3	5.2	1.0	6.9	7.6	8.9	10.0	2.8	5.8	5.2
Cameroon	56.6	5.8	4.6	1.8	9.1	10.0	9.3	10.0	0.9	0.0	5.2
Suriname	56.3	3.2	4.6	1.6	5.9	3.5	8.9	10.0	3.4	10.0	5.2
Angola	56.2	4.0	4.1	1.4	8.0	10.0	8.7	10.0	2.1	3.9	4.1
Algeria	56.1	8.0	4.1	0.2	7.9	7.8	9.2	10.0	1.0	5.5	2.3
Egypt	55.7	10.0	5.3	1.3	8.2	10.0	9.0	6.3	2.3	1.1	2.3
Venezuela, Bolivarian Republic of	55.5	3.4	4.1	2.1	6.7	7.2	8.0	9.3	4.1	8.1	2.5
Macedonia, the former Yugoslav Republic of	55.5	9.3	5.0	0.4	6.9	8.8	8.4	10.0	2.1	3.1	1.6
Belize	55.3	3.0	4.5	0.9	7.3	7.5	8.9	10.0	2.3	5.3	5.6
Viet Nam	55.2	8.5	3.4	2.8	9.2	9.4	7.9	10.0	2.0	0.1	1.8
Jamaica	55.1	4.7	5.0	0.7	7.3	4.7	9.3	10.0	3.7	4.2	5.5
Bahamas	54.9	5.5	9.6	0.4	4.3	1.4	7.4	10.0	4.5	6.9	5.0
Costa Rica	54.8	3.0	5.9	1.0	5.7	10.0	8.3	9.2	2.9	6.3	2.5
Senegal	54.6	3.6	0.9	1.4	9.2	9.4	9.4	10.0	0.8	4.9	5.2
Spain	54.6	6.2	5.7	1.1	6.0	9.0	6.3	10.0	3.1	4.5	2.6
United Arab Emirates	53.9	5.2	4.6	0.5	5.6	10.0	8.5	9.9	3.4	4.9	1.2
Fiji	53.9	2.4	2.0	0.9	8.9	9.3	8.6	10.0	2.4	5.9	3.5
Kenya	53.7	3.0	2.8	1.6	8.9	10.0	9.1	10.0	1.4	0.3	6.6
Singapore	53.6	7.0	4.9	1.9	7.0	7.1	7.3	10.0	4.3	4.0	0.1
Malta	53.5	9.6	4.4	0.2	6.4	6.2	6.6	10.0	3.3	4.8	2.0
Tanzania, United Republic of	53.4	2.8	4.0	2.4	9.2	10.0	9.5	10.0	0.8	0.2	4.6
Equatorial Guinea	53.4	5.3	6.9	1.8	3.5	10.0	8.0	10.0	4.0	0.6	3.3
Guyana	53.4	4.1	2.6	1.5	7.8	9.1	9.5	10.0	3.1	0.1	5.7
Global	53.4	5.8	3.6	1.3	7.8	9.8	8.0	10.0	3.9	2.8	0.4
Greece	53.3	8.9	6.4	0.2	7.6	6.0	6.7	10.0	2.2	2.8	2.6
Nigeria	52.9	4.3	3.2	1.3	8.4	10.0	9.4	10.0	0.4	0.0	5.9
Italy	52.8	6.4	6.1	0.0	7.4	5.9	6.4	10.0	2.6	5.7	2.2
Bosnia and Herzegovina	52.8	9.5	4.0	1.6	7.7	7.3	8.8	10.0	1.7	0.7	1.6
El Salvador	52.6	4.0	3.7	1.6	7.2	10.0	9.2	9.5	2.1	2.6	2.7
Gabon	52.5	2.7	7.1	2.1	6.4	9.3	8.8	10.0	2.6	0.0	3.6
Montenegro	52.4	10.0	7.6	0.5	6.7	5.5	6.5	10.0	2.3	1.9	1.5
Lao People's Democratic Republic	52.4	7.6	3.6	3.2	9.1	6.7	8.8	10.0	1.4	0.0	2.0
Malawi	52.4	1.4	3.0	2.5	9.6	10.0	9.6	10.0	0.4	0.0	5.9

Guinea	52.4	3.1	4.3	1.8	9.4	8.4	9.5	10.0	0.5	0.0	5.4
Panama	52.2	1.8	4.6	2.3	4.6	8.2	7.8	9.5	3.8	7.1	2.4
Sierra Leone	52.2	3.4	1.8	1.7	9.4	10.0	9.7	10.0	0.6	0.0	5.4
Serbia	51.8	6.4	4.4	0.7	7.0	9.5	7.7	10.0	2.5	1.9	1.6
Myanmar	51.7	5.1	2.1	2.3	9.2	10.0	9.0	10.0	2.2	0.0	1.8
Ghana	51.7	2.3	8.0	1.2	8.8	8.4	9.6	10.0	1.1	0.0	2.2
Seychelles	51.5	5.8	4.8	2.1	6.9	8.6	8.6	10.0	1.7	0.2	2.7
India	51.4	5.7	2.9	1.3	9.7	10.0	9.8	9.3	0.6	0.2	2.0
Iraq	51.4	9.0	2.1	0.4	7.8	4.8	9.6	9.9	1.4	4.1	2.2
Albania	51.4	10.0	6.3	0.1	7.4	5.7	7.8	10.0	2.5	0.2	1.6
Andorra	51.3	7.6	6.3	0.8	4.2	5.2	5.6	10.0	4.7	4.7	2.1
Mozambique	51.2	1.2	1.3	1.2	9.5	10.0	9.5	10.0	0.3	2.0	6.1
Norway	51.1	4.1	6.0	1.0	5.8	5.8	4.8	10.0	3.5	8.4	1.7
Benin	50.9	2.5	1.8	1.7	9.3	10.0	9.6	10.0	1.0	0.0	5.0
Belgium	50.9	6.8	3.9	0.9	5.9	3.4	6.3	9.9	3.3	7.3	3.2
South Sudan	50.8	2.3	2.2	1.7	9.0	10.0	9.2	10.0	0.8	0.0	5.6
Peru	50.7	3.4	4.9	1.6	6.6	9.1	9.3	9.3	1.6	1.9	2.9
Mali	50.6	3.6	1.5	1.5	9.3	10.0	8.8	10.0	0.7	0.0	5.3
Colombia	50.6	2.4	5.9	1.5	6.3	8.3	8.4	9.8	3.1	3.3	1.4
Mauritania	50.4	1.4	0.7	0.5	8.9	10.0	8.7	10.0	0.9	4.5	4.9
Portugal	50.4	8.2	4.9	0.8	7.3	4.1	6.2	10.0	2.9	3.7	2.2
Canada	50.3	5.9	5.9	1.3	3.6	10.0	6.0	8.1	6.0	1.7	1.7
Greenland	50.2	6.8	5.8	1.3	2.7	6.1	4.9	9.1	6.4	6.1	1.0
Nicaragua	50.1	0.7	2.2	1.9	8.1	10.0	9.4	9.5	1.8	3.5	3.0
Comoros	50.0	1.6	1.6	1.3	9.4	9.8	9.4	10.0	1.2	0.0	5.7
Zimbabwe	49.9	1.0	0.8	2.0	9.2	7.3	9.2	10.0	1.0	5.6	3.8
Djibouti	49.9	3.5	0.9	0.7	9.0	8.7	8.9	10.0	0.9	1.7	5.6
South Africa	49.9	2.6	1.7	2.5	7.0	4.5	8.1	10.0	3.5	6.1	3.9
United States	49.8	6.1	4.7	1.3	2.2	6.7	5.2	8.1	4.6	10.0	0.9
Sao Tome and Principe	49.8	2.7	1.8	1.3	9.0	9.7	9.3	10.0	0.8	0.0	5.1
Niger	49.8	3.0	1.1	1.0	9.6	10.0	8.9	10.0	0.5	0.0	5.6
Syrian Arab Republic	49.5	4.9	2.6	0.2	9.2	6.4	9.3	9.9	0.8	3.5	2.7
Honduras	49.5	3.1	3.5	1.7	8.0	9.6	9.1	9.5	2.1	0.0	3.0
Eritrea	49.5	1.5	1.4	1.5	9.5	9.6	9.5	10.0	0.4	0.0	6.0
Zambia	49.4	1.8	0.5	2.4	8.8	10.0	9.4	10.0	0.7	0.2	5.5
New Zealand	49.4	6.0	4.9	1.2	7.6	6.1	5.5	9.8	3.9	3.1	1.4
Bulgaria	49.4	9.8	2.4	0.8	6.4	3.8	6.4	10.0	2.4	5.9	1.4
Bhutan	49.3	3.9	2.4	1.9	9.7	9.4	9.4	9.4	1.1	1.0	1.1



Oman	49.3	6.8	9.5	0.9	4.3	5.2	8.2	9.9	3.0	0.0	1.6
Togo	48.9	1.7	0.5	1.5	9.5	10.0	9.6	10.0	0.6	0.0	5.4
Armenia	48.7	10.0	4.1	0.1	8.4	0.6	8.3	10.0	2.7	2.7	1.9
Malaysia	48.6	3.7	3.6	1.4	7.9	5.2	9.0	10.0	3.8	2.7	1.4
Lithuania	48.5	6.4	3.5	1.1	8.0	5.1	6.3	9.5	3.7	2.7	2.2
Denmark	48.4	6.1	6.1	0.7	6.5	2.3	6.4	10.0	4.6	2.2	3.5
Sudan	48.4	4.7	2.3	0.2	9.2	7.8	9.4	9.9	0.9	1.3	2.6
Burundi	48.2	1.3	1.2	0.7	9.6	9.4	9.5	10.0	0.1	0.0	6.3
Bolivia, Plurinational State of	48.2	2.2	3.6	1.3	7.3	5.4	7.9	9.0	3.6	4.8	3.1
Timor-Leste	47.9	2.0	1.0	2.2	9.3	10.0	9.2	10.0	2.2	0.0	1.9
Somalia	47.9	1.1	1.1	0.8	9.8	8.8	9.6	10.0	0.3	0.0	6.5
Thailand	47.9	2.8	5.9	2.5	6.9	5.4	9.0	10.0	2.4	1.7	1.1
Cambodia	47.9	2.3	1.5	3.2	9.4	9.5	9.1	10.0	0.7	0.0	2.1
Samoa	47.9	2.3	3.1	0.9	9.3	4.7	8.7	10.0	1.4	0.4	7.2
Ethiopia	47.8	1.3	0.5	0.8	9.4	10.0	9.5	10.0	0.3	0.0	6.0
Ecuador	47.8	2.8	7.5	1.2	4.8	3.5	7.4	8.6	3.0	6.0	2.9
Cyprus	47.7	5.2	4.1	0.4	6.3	4.7	7.0	10.0	2.4	5.0	2.5
Ukraine	47.7	8.2	2.1	0.5	9.3	2.5	8.3	10.0	2.5	1.6	2.7
Mexico	47.7	3.7	4.9	3.9	0.9	10.0	7.3	7.1	3.3	3.2	3.5
Maldives	47.5	4.7	4.8	0.8	7.6	6.1	9.4	10.0	2.2	0.1	1.9
United Kingdom	47.5	5.0	4.1	0.8	6.2	4.0	6.8	9.9	3.4	3.7	3.3
Netherlands	47.3	4.5	5.6	1.1	5.6	3.6	6.2	9.3	2.7	5.6	3.0
Burkina Faso	47.3	1.3	0.3	1.1	9.4	10.0	9.1	10.0	0.7	0.0	5.3
France	47.3	4.9	4.6	0.3	7.1	3.5	6.1	10.0	3.1	5.1	2.7
Lesotho	47.2	1.4	0.9	2.9	8.9	9.2	9.2	10.0	0.9	0.0	3.9
Belarus	47.2	8.6	3.4	0.3	8.6	1.4	6.4	10.0	3.4	2.8	2.3
China	47.1	7.3	3.2	1.1	8.8	4.8	7.0	10.0	1.7	3.0	0.0
Hungary	47.0	7.6	3.4	0.8	6.4	4.3	7.0	9.8	2.8	3.8	1.2
Palestine	46.9	4.7	2.5	0.3	9.2	6.2	9.3	9.9	1.0	0.8	2.8
Ireland	46.8	5.2	5.7	2.1	5.1	4.6	5.4	10.0	3.8	2.8	2.3
Australia	46.8	5.0	4.4	1.4	6.4	5.0	5.3	9.7	4.7	1.4	3.5
Solomon Islands	46.7	1.0	2.8	1.2	9.6	7.5	9.3	10.0	0.7	0.0	4.7
Congo	46.7	2.4	3.0	1.6	8.2	6.6	9.5	10.0	1.2	0.0	4.2
Moldova, Republic of	46.6	6.1	2.1	1.2	9.5	1.7	8.6	9.9	1.8	2.6	3.1
Gambia	46.6	2.1	0.4	1.6	9.4	6.5	9.7	10.0	0.4	1.1	5.4
Sri Lanka	46.5	2.6	2.0	1.9	8.6	9.1	9.8	10.0	1.3	0.0	1.3
Indonesia	46.5	2.6	3.5	2.6	9.6	5.8	9.6	10.0	1.0	0.2	1.6

Congo, the Democratic Republic of the	46.5	1.1	1.5	1.6	9.7	5.9	9.5	10.0	0.4	0.0	6.8
Russian Federation	46.5	5.8	3.3	0.8	8.2	2.6	7.2	10.0	3.6	2.7	2.4
Central African Republic	46.2	1.1	1.9	1.2	9.7	7.6	8.4	10.0	0.9	0.0	5.3
Estonia	46.1	6.1	3.7	1.2	8.0	4.7	7.1	9.1	2.9	1.2	2.2
Côte d'Ivoire	45.8	2.6	3.6	1.1	8.9	6.6	9.6	10.0	0.5	0.0	3.0
Guinea-Bissau	45.8	1.3	2.3	2.0	9.5	4.9	9.0	10.0	0.5	0.9	5.5
Liberia	45.7	1.8	2.1	1.4	9.6	4.2	9.7	10.0	0.9	0.0	5.9
Madagascar	45.7	1.1	2.2	2.2	9.5	4.5	9.3	10.0	0.9	0.0	6.0
Botswana	45.6	2.2	2.5	1.6	5.8	8.8	9.0	10.0	1.0	1.7	3.2
Romania	45.6	10.0	3.6	1.3	6.0	2.9	6.6	10.0	2.0	1.9	1.3
Austria	45.5	5.3	5.9	1.5	6.5	4.3	4.7	10.0	3.2	1.8	2.3
Chad	45.4	0.6	0.5	0.1	9.3	10.0	9.2	10.0	0.4	0.0	5.3
Saudi Arabia	45.4	5.5	3.7	0.8	3.1	6.2	9.1	10.0	4.3	1.3	1.5
Swaziland	45.2	1.2	3.6	2.5	7.5	7.2	8.6	10.0	1.2	0.0	3.5
Uruguay	45.1	3.3	4.3	0.3	4.3	3.4	6.8	10.0	3.6	7.2	1.9
Iceland	45.1	4.1	5.7	0.9	5.0	1.2	6.4	10.0	4.1	4.1	3.4
Kyrgyzstan	45.1	8.8	1.7	0.1	9.2	3.3	8.2	10.0	1.2	0.2	2.5
Croatia	45.0	4.7	4.7	1.0	5.8	2.6	7.4	10.0	1.4	6.0	1.4
Luxembourg	45.0	5.5	8.4	1.3	3.0	2.5	5.1	10.0	4.0	3.2	2.0
Tajikistan	44.6	8.6	1.2	0.0	9.3	1.8	9.2	10.0	1.0	0.9	2.6
Slovenia	44.5	4.4	5.9	1.4	4.5	4.0	6.4	8.6	3.4	4.7	1.3
Germany	44.5	4.8	3.7	1.4	5.9	3.1	5.9	9.8	2.6	4.7	2.5
Namibia	44.4	2.0	1.3	1.6	6.9	8.4	8.7	10.0	1.8	0.3	3.3
Kazakhstan	44.3	9.9	2.0	0.1	6.1	1.1	6.7	10.0	3.2	3.6	1.6
Bangladesh	44.1	1.8	1.3	3.0	9.9	6.9	9.8	9.4	0.3	0.6	1.3
Sweden	43.9	4.7	5.4	0.9	6.1	3.8	5.4	10.0	4.4	1.9	1.4
Latvia	43.9	6.5	2.6	0.8	8.2	1.3	6.9	6.4	5.1	3.9	2.2
Chile	43.8	6.1	3.6	0.7	3.8	4.5	6.0	10.0	3.9	3.3	1.8
Uzbekistan	43.7	10.0	2.5	0.0	8.5	0.6	7.9	10.0	1.7	0.3	2.1
Tonga	43.7	2.5	3.4	0.9	9.2	3.6	8.7	10.0	1.6	0.1	3.6
Philippines	43.6	4.1	5.4	2.4	6.9	2.7	8.4	10.0	1.8	0.0	1.8
Yemen	43.6	2.0	2.1	0.1	9.3	6.8	9.5	9.9	0.9	0.0	2.9
Marshall Islands	43.3	2.1	2.9	0.9	9.4	3.4	8.8	10.0	1.3	0.0	4.5
Vanuatu	43.2	1.8	2.3	0.8	9.5	4.6	8.9	10.0	0.9	0.1	4.2
Slovakia	43.0	5.8	3.3	0.9	6.5	3.0	6.8	9.4	2.3	3.8	1.3
Argentina	42.9	4.1	5.4	0.7	3.9	1.4	5.3	10.0	5.4	4.0	2.6
Kiribati	42.9	1.5	1.9	0.7	9.7	4.7	9.1	10.0	0.7	0.0	4.6

Micronesia, Federated States of	42.8	2.0	2.8	0.8	9.5	3.3	8.9	10.0	1.2	0.0	4.2
Switzerland	42.4	5.2	4.4	0.5	6.5	3.8	6.2	9.7	2.3	1.7	2.2
Azerbaijan	42.2	9.8	3.6	0.1	7.0	1.1	8.5	8.7	1.7	0.0	1.8
Brunei Darussalam	42.2	3.6	3.8	1.5	4.9	5.2	8.4	10.0	4.7	0.0	0.2
Poland	42.1	7.5	2.8	1.0	5.6	2.7	6.5	10.0	3.3	1.1	1.5
Papua New Guinea	41.7	1.7	2.4	0.6	9.5	3.0	9.0	10.0	0.7	0.0	4.7
Finland	41.4	4.4	4.1	1.1	6.7	2.4	6.7	10.0	3.2	0.4	2.6
Turkmenistan	41.2	9.7	3.5	0.1	7.0	0.8	6.2	10.0	2.2	0.0	1.7
Pakistan	40.8	1.7	1.5	0.2	9.8	6.9	9.2	9.2	1.1	0.0	1.2
Georgia	40.5	4.3	2.3	0.1	8.4	1.1	8.7	9.8	1.8	2.2	1.9
Czech Republic	40.2	4.1	3.4	1.9	4.7	4.0	6.7	10.0	2.7	1.6	1.2
Afghanistan	39.5	2.2	1.4	0.1	9.6	3.2	9.3	9.9	0.5	0.0	3.2
Mongolia	34.0	3.1	1.4	0.1	7.8	1.0	5.6	10.0	1.4	1.7	2.0

**Supplemental Table 4.** Alternate Healthy Eating Index and its component scores in men and women aged 25 years or older in 190 countries/ territories in 1990.

Countries/ Territories	AHEI	Vegetables	Fruit	Whole grains	Sugar sweetened beverages	Nuts / legumes	Red / processed meats	trans fat	Long-chain n-3 PUFAs (DHA + EPA)	PUFAs	Sodium
Lebanon	71.0	10.0	8.7	0.1	8.5	10.0	8.9	10.0	2.4	10.0	2.5
Israel	65.5	9.9	6.7	0.2	6.6	9.7	8.6	10.0	3.4	7.4	2.8
Dominican Republic	63.1	1.8	6.8	1.2	7.9	10.0	9.1	10.0	1.6	9.2	5.5
Bermuda	62.8	4.9	8.7	1.3	3.6	8.2	8.1	10.0	5.6	8.1	4.2
Taiwan, Province of China	62.7	6.5	4.4	1.3	9.0	10.0	7.4	10.0	2.2	10.0	2.0
Japan	60.9	6.9	2.7	2.1	7.6	10.0	8.1	10.0	10.0	3.5	0.0
Turkey	59.2	10.0	5.4	0.1	8.2	10.0	9.2	10.0	1.0	0.1	5.2
Tunisia	58.6	8.9	3.1	0.2	9.0	8.3	9.2	10.0	1.0	6.1	2.8
Cyprus	58.4	6.7	5.6	0.4	7.3	7.0	6.8	9.8	2.5	9.5	2.7
Libyan Arab Jamahiriya	58.4	9.2	4.8	0.2	6.4	9.4	8.7	9.3	1.7	6.6	2.1
Korea, Democratic People's Republic of	58.2	9.5	2.6	1.9	9.5	10.0	9.3	10.0	0.6	4.8	0.0
Bahamas	58.1	7.7	6.7	0.6	4.3	4.1	6.1	10.0	3.9	9.9	4.8
United Arab Emirates	58.0	10.0	6.0	0.4	3.2	10.0	7.4	9.4	3.8	6.5	1.4
Qatar	57.9	10.0	7.0	0.3	3.2	10.0	8.0	9.4	4.4	4.0	1.5
Trinidad and Tobago	57.6	1.7	3.2	0.7	5.7	10.0	9.2	10.0	1.9	9.8	5.4
Brazil	57.2	1.9	4.4	1.4	6.9	10.0	7.7	9.9	2.5	10.0	2.6
Korea, Republic of	57.1	10.0	2.4	2.8	9.4	10.0	8.5	9.2	1.1	3.2	0.5
Haiti	56.6	2.2	4.6	0.8	9.2	10.0	9.5	10.0	0.5	3.7	6.0
Antigua and Barbuda	56.0	3.3	5.7	1.0	6.2	7.8	8.7	10.0	2.9	5.7	4.7
Malta	55.9	6.9	3.6	0.2	8.0	7.2	6.8	9.8	2.3	8.4	2.6
Guinea	55.8	4.5	5.4	1.6	9.4	9.3	9.7	10.0	0.2	0.0	5.6
Fiji	55.7	1.4	1.0	0.8	9.2	8.6	8.2	10.0	1.3	9.6	5.7
Cameroon	55.2	2.9	5.6	1.5	9.0	10.0	9.3	10.0	1.6	0.0	5.4
Uganda	55.1	1.3	9.0	1.6	9.6	10.0	9.4	10.0	0.7	0.0	3.4
Bahrain	55.0	9.5	5.1	0.3	5.3	9.7	8.5	9.3	2.6	2.6	1.9
Barbados	54.2	2.6	3.4	0.9	6.2	9.7	7.6	10.0	3.6	5.7	4.5
Italy	54.2	9.0	5.6	0.1	7.7	5.7	6.3	10.0	2.9	4.6	2.4
Mauritius	54.0	2.4	0.9	1.2	8.8	10.0	9.2	10.0	1.3	10.0	0.1
Saint Lucia	53.9	2.7	4.5	1.0	7.3	7.8	8.9	10.0	2.1	4.6	5.1
Cuba	53.8	3.1	4.1	1.0	8.0	10.0	8.8	10.0	1.5	2.0	5.2
Spain	53.7	8.7	4.8	0.8	6.9	7.1	6.1	10.0	2.8	3.2	3.3
Rwanda	53.7	1.5	8.5	1.0	9.6	10.0	9.8	10.0	0.1	0.0	3.3
Greece	53.7	10.0	6.6	0.1	7.6	6.8	6.7	9.6	2.2	1.1	2.9

Kuwait	53.5	9.7	3.8	0.7	4.6	6.9	8.2	9.3	2.8	6.2	1.4
Guatemala	53.4	2.5	2.4	2.0	8.0	10.0	9.5	9.8	1.0	0.7	7.4
Dominica	53.1	2.5	4.2	0.9	7.8	7.8	9.0	10.0	1.8	4.3	4.9
Jordan	53.1	6.4	3.0	0.1	8.7	8.8	9.2	9.3	2.2	2.7	2.7
Iran, Islamic Republic of	52.9	7.9	5.0	0.1	8.6	7.2	9.2	5.4	1.0	6.0	2.6
Grenada	52.7	2.4	3.9	0.9	8.0	7.6	9.0	10.0	1.7	4.1	5.1
Saint Vincent and the Grenadines	52.4	2.3	3.8	0.9	7.9	7.6	9.0	10.0	1.6	3.9	5.3
Suriname	52.4	2.9	3.1	1.7	7.0	5.3	9.1	10.0	2.4	5.8	5.1
Senegal	52.3	1.7	0.6	1.0	9.3	9.8	9.4	10.0	0.5	4.5	5.6
Paraguay	52.3	3.4	5.0	1.5	8.0	10.0	6.1	9.7	2.1	3.7	2.8
Belize	52.2	2.2	3.5	0.8	8.3	7.7	9.1	10.0	1.5	3.7	5.4
Gabon	52.2	2.3	8.0	2.0	6.4	9.5	8.3	10.0	1.4	0.0	4.3
Portugal	52.1	7.9	3.8	0.9	7.9	5.3	7.5	9.4	1.9	4.3	3.2
Jamaica	52.1	3.3	5.5	0.8	7.8	4.0	9.2	10.0	2.5	3.8	5.1
Panama	51.9	1.5	3.5	1.7	7.1	6.2	8.1	8.3	2.1	9.7	3.8
Morocco	51.8	5.0	2.5	0.1	9.3	9.4	9.4	9.2	0.8	2.9	3.0
Cape Verde	51.6	1.4	1.7	1.8	9.3	10.0	9.1	10.0	0.5	2.3	5.5
Sierra Leone	51.4	2.8	1.7	1.7	9.4	10.0	9.8	10.0	0.3	0.0	5.8
Nigeria	51.2	2.8	2.8	1.1	9.0	9.8	9.5	10.0	0.4	0.0	5.8
Kenya	50.5	2.2	2.3	1.9	9.2	10.0	9.1	10.0	0.9	0.0	4.9
Gambia	50.5	1.6	0.2	1.6	9.3	10.0	9.5	10.0	0.3	2.2	5.8
Andorra	50.2	7.6	5.9	0.9	4.4	5.0	5.4	9.9	4.6	4.4	2.2
Iraq	49.9	9.7	3.0	0.3	8.5	5.2	9.5	9.3	1.0	0.9	2.5
Mali	49.8	3.5	1.0	0.7	9.6	9.5	9.1	10.0	0.6	0.0	5.9
Guyana	49.8	1.3	2.7	1.6	8.8	8.7	9.6	10.0	1.1	0.0	5.9
Benin	49.7	2.5	1.4	1.2	9.5	10.0	9.6	10.0	0.5	0.0	5.0
Angola	49.7	1.4	1.7	0.9	8.8	8.2	9.2	10.0	0.6	4.1	4.9
Tanzania, United Republic of	49.3	2.4	2.0	2.9	9.4	10.0	9.4	10.0	0.5	0.0	2.7
Venezuela, Bolivarian Republic of	49.3	1.5	4.8	1.9	6.2	6.3	8.5	6.9	2.5	7.2	3.6
Malawi	49.3	1.6	2.2	2.6	9.6	10.0	9.7	10.0	0.2	0.0	3.3
Mauritania	49.3	0.7	0.5	0.5	9.1	10.0	8.8	10.0	0.6	3.6	5.4
Togo	49.2	2.2	0.5	1.2	9.4	10.0	9.6	10.0	0.3	0.0	5.9
Sao Tome and Principe	49.0	2.2	1.5	1.1	9.3	9.4	9.4	10.0	0.6	0.0	5.5
Seychelles	48.8	4.2	3.5	2.1	8.4	7.1	8.9	10.0	1.2	2.4	1.1
Belgium	48.6	5.5	3.1	1.1	6.6	3.4	6.6	9.3	2.9	6.8	3.2

Bolivia, Plurinational State of	48.5	3.1	4.1	0.8	8.5	5.2	8.1	8.9	1.4	5.6	3.0
Honduras	48.4	1.7	3.8	1.8	8.5	9.8	9.3	8.3	0.9	0.0	4.3
Nepal	48.3	2.9	1.3	2.1	9.9	7.9	9.4	9.0	0.7	1.1	4.1
Burkina Faso	48.2	1.5	0.3	0.9	9.6	10.0	9.4	10.0	0.5	0.0	5.9
Niger	48.2	1.9	0.4	1.0	9.6	10.0	9.0	10.0	0.5	0.0	5.9
Botswana	48.1	1.5	1.3	1.6	8.0	10.0	8.9	10.0	0.9	2.4	3.3
Serbia	48.0	6.0	4.0	0.7	7.4	7.0	7.9	10.0	2.1	2.8	0.1
Congo	48.0	1.6	2.5	1.6	8.7	7.8	9.5	10.0	0.6	0.8	4.9
Singapore	47.8	5.8	3.1	2.0	8.4	6.7	8.2	10.0	2.1	1.6	0.1
South Sudan	47.7	2.3	2.2	1.7	8.9	10.0	9.2	10.0	0.8	0.0	2.7
Liberia	47.7	2.4	2.7	1.8	9.6	4.9	9.7	10.0	0.6	0.1	5.9
Nicaragua	47.7	0.6	1.9	1.5	8.4	10.0	9.4	8.2	0.9	2.6	4.3
Ecuador	47.7	1.7	8.9	1.0	5.9	4.6	8.6	8.3	1.4	4.8	2.5
Norway	47.6	3.1	4.4	0.6	7.0	1.7	6.4	10.0	2.5	9.9	2.0
New Zealand	47.6	6.4	4.8	1.6	7.9	5.3	5.0	8.7	3.1	2.8	1.9
Congo, the Democratic Republic of the	47.5	1.2	1.8	2.0	9.4	6.0	9.4	10.0	0.4	0.0	7.4
Macedonia, the former Yugoslav Republic of	47.4	9.1	3.5	0.3	7.4	6.3	8.4	10.0	1.7	0.4	0.2
Costa Rica	47.3	1.7	5.0	1.0	7.0	10.0	8.3	6.2	2.0	2.2	3.8
Montenegro	47.2	9.1	5.8	0.5	7.1	4.8	7.1	9.7	2.0	1.0	0.1
Samoa	47.1	1.8	2.3	0.8	9.5	4.8	8.8	10.0	0.9	0.4	7.9
El Salvador	47.0	1.8	2.4	1.7	8.5	9.7	9.5	8.2	0.9	0.0	4.2
Oman	46.9	7.4	5.1	0.5	6.3	5.6	8.7	9.3	1.8	0.0	2.1
Zimbabwe	46.9	0.8	0.6	2.1	8.8	8.5	9.4	10.0	0.5	3.4	2.9
Solomon Islands	46.8	1.1	1.9	0.9	9.7	7.3	9.3	10.0	0.4	0.0	6.1
Comoros	46.6	1.7	1.7	1.5	9.4	9.6	9.4	10.0	0.5	0.0	2.8
Netherlands	46.6	4.0	5.3	1.2	6.3	3.6	5.9	7.7	2.5	6.8	3.3
Lesotho	46.6	1.4	1.0	2.5	9.5	6.8	9.2	10.0	0.6	1.6	4.1
India	46.5	3.0	1.3	1.3	9.9	10.0	9.7	8.9	0.4	0.0	2.0
Chad	46.5	0.8	0.7	0.1	9.5	10.0	9.1	10.0	0.5	0.0	5.8
United Kingdom	46.5	5.0	4.1	0.8	7.1	3.7	6.6	9.3	2.7	3.0	4.2
Egypt	46.3	9.1	3.1	1.0	9.0	8.3	9.3	2.1	1.3	0.1	2.8
Swaziland	46.1	1.5	3.0	1.9	8.3	7.5	8.4	10.0	1.0	1.1	3.4
Saudi Arabia	46.0	8.0	4.3	0.7	3.8	4.0	9.2	10.0	2.6	1.6	1.9
Bhutan	45.9	2.1	1.3	1.8	9.9	8.0	9.6	9.1	0.6	0.0	3.6
United States	45.9	6.0	5.0	1.3	1.0	6.5	4.6	5.8	4.0	9.4	2.2

Timor-Leste	45.8	1.7	1.0	2.1	9.7	9.1	9.3	10.0	2.5	0.0	0.4
Global	45.5	4.0	2.4	1.2	7.9	8.1	8.2	9.5	2.5	1.6	0.2
Greenland	45.5	6.6	5.2	1.3	2.2	6.3	4.4	7.6	5.2	5.0	1.8
Algeria	45.5	4.3	1.8	0.2	8.2	6.0	9.4	9.7	0.9	2.5	2.5
Central African Republic	45.5	1.3	2.3	1.2	9.6	5.7	8.8	10.0	0.9	0.0	5.6
Sudan	45.4	3.8	1.7	0.2	9.6	7.2	9.5	9.2	0.5	0.4	3.3
Eritrea	45.3	1.2	1.1	1.5	9.7	8.5	9.6	10.0	0.3	0.0	3.5
Bosnia and Herzegovina	45.2	7.1	1.2	1.1	9.3	6.2	9.2	10.0	0.8	0.0	0.4
France	45.2	6.2	3.6	0.4	7.1	3.3	5.7	9.9	3.4	2.3	3.2
Ghana	45.1	1.6	4.0	0.8	9.3	4.3	9.7	10.0	0.5	0.0	4.9
Bulgaria	45.1	7.1	3.2	0.3	6.9	5.7	6.9	10.0	2.5	2.4	0.1
Burundi	45.0	1.3	1.3	1.0	9.6	8.8	9.5	10.0	0.2	0.0	3.3
Somalia	45.0	1.1	1.1	1.1	9.7	8.1	9.6	10.0	0.4	0.5	3.3
Mozambique	45.0	0.7	1.0	0.9	9.8	8.5	9.7	10.0	0.2	0.7	3.5
Maldives	44.8	4.0	2.5	0.6	9.2	8.1	9.8	10.0	0.6	0.0	0.1
Guinea-Bissau	44.7	1.1	2.3	2.2	9.5	3.8	9.1	10.0	0.3	0.8	5.7
Vanuatu	44.6	1.6	1.9	0.7	9.6	4.8	8.9	10.0	0.7	0.3	6.0
South Africa	44.6	2.7	1.6	2.6	7.2	4.3	8.4	10.0	1.8	2.1	3.7
Palestine	44.5	4.3	2.2	0.2	9.4	5.9	9.4	9.2	0.7	0.0	3.3
Thailand	44.5	2.3	4.1	2.2	8.5	6.3	9.2	10.0	1.8	0.0	0.2
Pakistan	44.5	1.7	1.6	0.1	9.9	8.2	9.3	9.1	0.9	0.0	3.6
Colombia	44.4	2.1	4.2	1.5	7.3	6.9	8.5	8.6	1.7	2.0	1.6
Syrian Arab Republic	44.4	4.2	2.2	0.3	9.3	5.9	9.3	9.3	0.8	0.1	3.0
Ethiopia	44.3	0.7	0.2	0.6	9.7	10.0	9.5	10.0	0.3	0.0	3.4
Equatorial Guinea	44.3	1.0	1.4	1.2	9.6	5.6	9.5	10.0	0.3	0.0	5.7
Peru	44.3	1.8	2.7	1.3	7.8	6.9	9.5	8.8	1.0	1.9	2.7
Côte d'Ivoire	44.2	2.7	4.1	1.0	8.9	4.4	9.5	10.0	0.5	0.0	3.1
Madagascar	44.2	1.6	2.7	2.2	9.5	5.4	8.8	10.0	0.9	0.0	3.1
Kiribati	44.2	1.4	1.8	0.7	9.6	4.7	9.0	10.0	0.6	0.2	6.0
Ireland	44.1	3.9	3.1	1.7	7.6	3.3	6.2	10.0	3.3	2.3	2.9
Australia	44.0	4.4	3.9	1.6	6.5	5.7	5.1	8.4	3.7	1.0	3.7
Marshall Islands	43.9	1.8	2.4	0.8	9.6	3.6	8.8	10.0	0.9	0.0	6.0
Indonesia	43.9	1.4	1.3	2.6	9.8	8.5	9.7	10.0	0.4	0.0	0.2
Myanmar	43.8	2.7	1.0	2.0	9.8	8.0	9.7	10.0	0.3	0.0	0.4
Namibia	43.8	1.2	1.2	0.7	8.0	10.0	8.7	10.0	0.8	0.0	3.3
Tonga	43.7	1.9	2.7	0.9	9.5	3.7	8.7	10.0	1.0	0.1	5.2
Micronesia, Federated States of	43.5	1.8	2.4	0.8	9.6	3.6	8.8	10.0	0.8	0.0	5.6

Yemen	43.1	2.6	1.4	0.0	9.5	7.0	9.5	9.2	0.7	0.0	3.2
Moldova, Republic of	43.1	5.7	3.3	0.9	9.3	1.1	8.3	9.8	1.3	0.9	2.5
Denmark	43.0	3.9	3.3	1.8	6.9	1.5	5.2	9.6	3.0	4.4	3.4
Germany	42.7	3.9	4.5	1.9	6.5	2.6	5.2	8.8	2.3	4.2	2.9
Papua New Guinea	42.7	1.4	1.9	0.7	9.6	3.3	9.0	10.0	0.5	0.0	6.2
Austria	42.7	3.7	5.7	1.7	7.3	2.8	4.9	10.0	2.6	1.3	2.7
Luxembourg	42.5	4.0	7.6	1.2	5.2	1.3	5.7	9.8	2.8	2.5	2.5
Malaysia	42.4	1.5	2.4	1.4	9.1	4.9	9.0	10.0	2.4	1.5	0.1
Canada	42.4	5.9	5.0	1.3	3.6	8.0	5.3	5.3	4.7	1.4	1.9
Bangladesh	42.3	0.7	0.5	2.7	9.9	5.3	9.8	9.0	0.2	0.2	3.9
Romania	41.7	7.9	2.5	0.8	6.9	3.0	7.3	9.7	1.7	1.7	0.1
Chile	41.6	5.5	2.1	0.2	6.3	4.1	7.9	10.0	1.7	2.4	1.6
Croatia	41.6	4.4	3.5	0.9	6.5	4.0	8.4	9.7	1.3	2.8	0.1
Russian Federation	41.4	4.7	1.8	0.4	8.3	2.6	6.7	10.0	3.1	1.3	2.5
Albania	41.4	6.2	1.9	0.1	8.4	4.7	8.7	9.7	0.8	0.4	0.4
Ukraine	41.3	4.9	1.8	0.1	9.1	3.5	7.6	10.0	1.9	0.3	2.1
Sri Lanka	41.1	1.7	1.9	1.5	9.4	5.7	9.9	10.0	0.8	0.0	0.2
Philippines	41.1	3.9	4.8	1.9	7.9	2.5	9.0	10.0	0.8	0.0	0.2
Djibouti	41.0	3.0	0.5	0.6	8.7	3.4	9.1	10.0	0.5	2.4	2.8
Zambia	40.9	1.9	0.5	2.9	9.2	3.3	9.5	10.0	0.6	0.1	2.8
Sweden	40.8	3.2	3.9	0.8	7.0	2.4	6.4	10.0	2.6	2.8	1.6
China	40.7	2.9	0.9	1.2	9.7	6.3	8.5	10.0	0.5	0.6	0.0
Mexico	40.6	2.9	4.3	2.6	2.6	10.0	7.9	1.4	1.7	3.4	3.7
Viet Nam	40.5	2.6	2.0	2.5	9.8	3.6	9.2	10.0	0.5	0.0	0.3
Lithuania	40.4	4.3	2.7	0.2	8.8	3.2	6.6	9.4	3.0	0.1	2.1
Switzerland	40.3	4.8	5.4	0.7	6.6	3.1	5.9	8.2	2.1	1.0	2.5
Brunei Darussalam	40.2	3.8	3.3	1.7	4.3	6.3	7.6	10.0	3.2	0.0	0.1
Armenia	39.9	7.4	2.6	0.1	8.8	0.5	8.8	10.0	1.1	0.0	0.8
Poland	39.8	6.4	1.7	0.2	7.8	2.4	6.4	9.9	2.6	0.5	2.0
Lao People's Democratic Republic	39.4	1.4	1.4	2.8	9.7	3.7	9.4	10.0	0.7	0.0	0.3
Cambodia	39.0	2.7	1.1	2.8	9.8	2.5	9.3	10.0	0.5	0.0	0.4
Finland	38.8	3.0	3.4	1.1	7.3	1.9	6.7	9.6	2.7	0.0	3.1
Uzbekistan	38.6	7.5	1.1	0.0	9.0	0.3	8.4	10.0	1.2	0.0	1.0
Argentina	38.5	4.1	3.7	0.1	4.0	1.4	5.7	10.0	3.9	3.1	2.6
Afghanistan	38.4	2.1	1.6	0.2	9.7	2.7	8.9	9.2	0.4	0.0	3.5
Iceland	38.2	2.0	3.5	0.2	6.4	0.3	6.4	9.8	2.7	3.3	3.5
Hungary	38.0	4.9	3.0	1.0	7.0	3.5	5.4	8.6	3.2	1.5	0.0



Estonia	37.7	3.3	2.6	0.4	8.8	1.7	6.9	9.0	2.3	0.7	2.0
Georgia	37.7	4.9	3.2	0.1	8.3	1.3	8.4	9.8	1.3	0.0	0.5
Tajikistan	37.5	6.0	1.4	0.0	8.8	0.7	9.1	10.0	0.6	0.0	0.9
Belarus	37.4	4.4	1.9	0.0	9.0	0.5	6.3	10.0	3.0	0.0	2.2
Slovenia	36.9	3.4	4.0	1.3	5.8	3.3	6.3	8.4	3.0	1.4	0.1
Slovakia	36.7	4.2	2.6	1.0	7.5	5.0	6.5	7.0	2.1	0.8	0.1
Turkmenistan	35.7	5.5	1.5	0.0	8.2	0.7	7.9	10.0	1.1	0.0	0.7
Kyrgyzstan	35.5	4.3	1.0	0.1	8.9	1.2	7.5	10.0	1.3	0.5	0.9
Azerbaijan	35.3	4.1	3.5	0.0	8.3	0.6	9.1	8.1	0.9	0.0	0.7
Czech Republic	35.3	3.6	3.0	2.0	5.9	2.7	6.0	9.0	2.4	0.5	0.1
Latvia	35.3	4.7	2.3	0.1	8.6	0.5	6.7	6.2	3.4	0.8	1.9
Uruguay	34.6	2.2	2.8	0.4	5.9	2.4	5.4	10.0	3.1	1.1	1.4
Kazakhstan	34.3	3.6	0.6	0.0	7.5	0.6	7.2	10.0	2.4	1.7	0.5
Mongolia	28.4	1.0	0.3	0.0	8.9	1.0	4.8	10.0	1.4	0.0	1.0

**Supplemental Table 5.** Percentage reductions in total deaths as a result of improvements in the Alternate Healthy Eating Index from the current diet to the reference healthy die in men and women aged 25 years or older in 190 countries/territories in 2017. <sup>1</sup>

Countries/ Territories	PAF <sup>2</sup>	PAF <sup>3</sup>
Afghanistan	28.5 (15.0-39.4)	29.2 (24.4-33.8)
Albania	23.9 (9.4-36.4)	28.3 (23.1-33.4)
Algeria	23.6 (11.3-33.9)	24.3 (19.8-28.6)
Andorra	22.8 (8.6-34.2)	26.9 (21.8-31.5)
Angola	15.5 (8.5-22.4)	14.6 (12.3-17.2)
Antigua and Barbuda	20.5 (9.4-30.5)	21.5 (17.5-25.5)
Argentina	27.3 (11.6-39.1)	29.3 (23.9-34.0)
Armenia	29.0 (16.3-40.2)	29.9 (25.1-34.7)
Australia	26.1 (9.6-38.4)	30.1 (24.4-35.1)
Austria	28.9 (13.0-40.1)	31.6 (25.9-36.2)
Azerbaijan	32.6 (15.2-45.4)	33.2 (26.7-38.8)
Bahrain	23.8 (13.1-32.8)	22.2 (18.2-26.1)
Bangladesh	28.6 (14.6-41.6)	29.4 (24.7-34.5)
Barbados	20.6 (10.3-29.8)	22.6 (18.7-26.3)
Belarus	28.7 (15.6-39.7)	30.3 (25.2-35.1)
Belgium	23.4 (9.3-35.2)	26.9 (21.9-31.6)
Belize	20.8 (9.0-30.4)	20.5 (16.5-24.2)
Benin	17.1 (8.3-25.0)	17.5 (14.5-20.5)
Bermuda	15.9 (7.3-25.0)	18.0 (14.7-21.8)
Bhutan	26.0 (11.5-38.5)	24.7 (20.1-29.5)
Bolivia, Plurinational State of	25.0 (10.3-37.0)	25.6 (20.9-30.3)
Bosnia and Herzegovina	24.6 (11.1-35.8)	28.1 (23.0-32.7)
Botswana	16.5 (7.7-23.4)	17.2 (14.1-19.9)
Brazil	19.0 (8.0-27.3)	19.9 (16.1-23.1)
Brunei Darussalam	27.9 (13.4-39.5)	29.9 (24.6-34.9)
Bulgaria	26.9 (11.6-38.5)	30.0 (24.3-34.8)
Burkina Faso	18.7 (9.2-26.9)	18.6 (15.4-22.0)
Burundi	17.4 (9.1-24.1)	16.4 (13.7-19.0)
Cambodia	22.7 (8.1-34.6)	23.2 (18.7-27.6)
Cameroon	14.0 (5.7-20.7)	13.9 (11.2-16.4)
Canada	24.7 (9.7-37.1)	28.2 (22.8-33.3)
Cape Verde	17.7 (7.4-26.0)	18.9 (15.3-22.3)
Central African Republic	15.2 (7.4-21.4)	14.6 (11.9-17.1)
Chad	18.5 (7.7-26.2)	18.5 (15.0-21.5)
Chile	27.2 (10.8-39.9)	30.2 (24.9-35.2)
China	24.6 (8.6-37.1)	29.7 (24.2-34.7)
Colombia	23.4 (8.6-35.0)	25.1 (20.2-29.5)
Comoros	21.2 (10.0-30.2)	21.4 (17.6-25.0)
Congo	18.4 (8.0-25.6)	18.0 (14.5-20.9)
Costa Rica	23.3 (10.7-34.9)	24.3 (20.1-28.8)
Côte d'Ivoire	17.4 (7.6-24.6)	17.1 (13.9-20.0)
Croatia	27.8 (12.3-41.3)	31.8 (26.1-37.5)
Cuba	17.1 (7.8-25.6)	18.8 (15.3-22.3)
Cyprus	27.6 (13.7-40.3)	29.6 (24.6-35.0)
Czech Republic	29.8 (12.9-42.9)	33.5 (27.2-39.1)
Congo, the Democratic Republic of the	19.6 (9.8-28.1)	18.6 (15.3-22.1)
Denmark	25.4 (9.1-37.1)	29.1 (23.5-33.9)

Djibouti	18.9 (9.5-27.2)	18.8 (15.5-22.2)
Dominica	22.4 (9.6-32.9)	23.8 (19.3-28.1)
Dominican Republic	16.0 (7.3-23.5)	16.4 (13.3-19.3)
Ecuador	25.6 (10.2-37.4)	25.8 (21.1-30.2)
Egypt	26.2 (14.1-37.4)	24.3 (20.0-28.8)
El Salvador	23.7 (10.9-35.4)	22.6 (18.8-26.9)
Equatorial Guinea	13.8 (6.5-19.5)	13.1 (10.7-15.3)
Eritrea	17.3 (7.9-24.3)	17.1 (13.9-19.8)
Estonia	28.6 (15.8-41.3)	31.3 (26.4-36.8)
Ethiopia	19.5 (9.1-27.7)	19.0 (15.6-22.1)
Micronesia, Federated States of	29.0 (14.0-41.7)	29.0 (23.9-34.2)
Fiji	27.9 (15.5-37.9)	25.6 (20.7-30.0)
Finland	27.9 (9.8-41.2)	33.3 (27.0-38.6)
France	23.6 (8.9-35.1)	29.0 (23.8-33.5)
Gabon	19.4 (9.1-27.7)	19.0 (15.5-22.3)
Georgia	30.9 (14.6-44.5)	34.2 (28.3-39.8)
Germany	28.7 (13.0-41.3)	31.7 (26.2-36.9)
Ghana	16.5 (7.5-23.5)	17.0 (13.9-19.7)
Greece	23.0 (8.5-34.4)	27.1 (22.0-31.6)
Greenland	22.4 (10.1-33.0)	25.5 (20.9-29.9)
Grenada	22.5 (9.9-33.0)	23.5 (18.9-27.7)
Guatemala	20.4 (9.1-29.4)	19.0 (15.5-22.2)
Guinea	16.9 (7.9-24.9)	17.9 (14.8-21.0)
Guinea-Bissau	18.5 (8.6-26.6)	18.4 (15.1-21.6)
Guyana	23.0 (12.1-33.0)	22.8 (18.9-26.9)
Haiti	20.2 (9.7-29.4)	20.2 (16.5-23.8)
Honduras	26.4 (13.3-38.0)	25.0 (20.6-29.6)
Hungary	27.7 (12.9-39.4)	30.8 (25.2-35.7)
Iceland	26.0 (12.0-37.9)	30.2 (25.0-35.1)
India	23.0 (8.6-32.7)	21.4 (16.8-25.1)
Indonesia	25.8 (11.6-37.1)	27.1 (22.5-31.5)
Iran, Islamic Republic of	19.2 (9.0-28.4)	19.9 (16.1-23.7)
Iraq	19.5 (8.2-28.5)	20.5 (16.5-24.2)
Ireland	26.1 (12.0-38.9)	30.1 (25.0-35.3)
Israel	17.3 (7.4-27.1)	19.2 (15.7-23.0)
Italy	23.0 (5.4-35.3)	27.6 (21.6-32.5)
Jamaica	22.4 (8.2-33.6)	24.4 (19.4-28.9)
Japan	16.2 (5.8-25.3)	20.8 (17.1-24.2)
Jordan	22.4 (9.8-32.1)	22.8 (18.4-26.7)
Kazakhstan	28.8 (16.1-40.1)	29.8 (25.2-34.5)
Kenya	15.7 (7.5-22.4)	14.5 (11.9-17.0)
Kiribati	28.7 (15.6-39.2)	28.0 (23.4-32.3)
Kuwait	21.0 (11.2-30.2)	21.3 (17.4-25.2)
Kyrgyzstan	30.0 (15.6-42.5)	30.1 (24.9-35.3)
Lao People's Democratic Republic	23.1 (9.3-33.7)	23.6 (19.1-27.6)
Latvia	28.3 (14.1-40.1)	32.1 (26.7-37.1)
Lebanon	19.7 (10.0-28.3)	21.0 (17.2-24.8)
Lesotho	14.9 (7.2-20.9)	15.1 (12.5-17.4)
Liberia	19.3 (8.7-26.1)	19.1 (15.6-21.8)
Libyan Arab Jamahiriya	20.8 (10.4-29.6)	21.1 (17.2-24.7)
Lithuania	27.3 (13.2-38.7)	29.2 (23.7-34.1)

Luxembourg	26.3 (12.0-38.3)	30.5 (25.4-35.3)
Macedonia, the former Yugoslav Republic of	21.8 (9.2-33.5)	26.4 (21.7-31.2)
Madagascar	22.6 (9.7-32.7)	23.0 (18.7-27.0)
Malawi	15.8 (7.7-23.0)	15.2 (12.6-18.0)
Malaysia	22.6 (10.4-31.6)	23.7 (19.4-27.3)
Maldives	28.0 (12.6-41.1)	28.1 (23.1-33.2)
Mali	19.0 (9.1-27.2)	19.2 (15.8-22.4)
Malta	24.0 (11.1-34.7)	26.8 (22.0-31.2)
Marshall Islands	29.1 (11.1-40.8)	29.0 (23.0-33.7)
Mauritania	21.6 (9.4-31.5)	22.1 (17.9-26.0)
Mauritius	24.4 (10.6-35.6)	22.7 (18.4-26.9)
Mexico	29.6 (13.8-42.6)	27.0 (22.3-31.8)
Moldova, Republic of	29.3 (13.3-40.9)	29.9 (24.0-34.7)
Mongolia	28.6 (11.7-42.0)	34.4 (28.5-39.9)
Montenegro	23.2 (9.2-35.0)	28.2 (23.0-33.0)
Morocco	22.3 (11.6-31.3)	22.3 (18.2-26.1)
Mozambique	12.2 (4.8-17.8)	13.1 (10.6-15.3)
Myanmar	24.8 (11.6-34.9)	23.8 (19.7-27.5)
Namibia	17.4 (8.2-24.9)	17.9 (14.8-20.9)
Nepal	22.2 (10.0-32.2)	20.2 (16.3-23.9)
Netherlands	24.3 (9.4-35.7)	29.4 (24.1-33.9)
New Zealand	25.5 (12.6-37.0)	29.1 (24.4-33.9)
Nicaragua	27.5 (12.0-41.2)	26.4 (21.9-31.4)
Niger	16.6 (8.1-23.4)	16.9 (14.1-19.5)
Nigeria	15.3 (7.2-22.7)	15.0 (12.4-17.8)
Korea, Democratic People's Republic of	22.3 (8.4-34.0)	23.3 (18.8-27.6)
Norway	23.1 (10.1-33.9)	26.8 (22.2-31.2)
Oman	21.9 (10.9-31.1)	22.2 (18.1-26.3)
Pakistan	28.4 (14.6-40.8)	29.2 (24.6-34.2)
Palestine	26.8 (10.0-38.5)	28.9 (23.2-33.7)
Panama	22.5 (9.5-33.3)	24.2 (20.0-28.4)
Papua New Guinea	27.6 (11.9-38.7)	26.5 (21.4-30.9)
Paraguay	21.4 (9.1-31.7)	21.9 (17.7-25.9)
Peru	22.0 (9.2-31.9)	23.6 (19.5-27.3)
Philippines	26.0 (11.9-37.2)	26.7 (22.1-31.1)
Poland	27.9 (11.2-40.8)	32.3 (26.1-37.8)
Portugal	23.3 (7.7-35.3)	27.4 (22.1-32.0)
Qatar	16.1 (7.8-23.3)	15.6 (12.5-18.7)
Romania	27.5 (11.3-39.8)	31.1 (25.3-36.1)
Russian Federation	27.0 (13.2-39.0)	29.4 (24.2-34.4)
Rwanda	17.3 (8.0-25.2)	16.1 (13.1-19.0)
Saint Lucia	21.9 (9.6-32.5)	23.2 (18.9-27.4)
Saint Vincent and the Grenadines	22.8 (11.6-32.3)	23.2 (19.0-27.2)
Samoa	28.1 (13.3-40.1)	28.1 (23.2-32.7)
Sao Tome and Principe	25.8 (12.9-37.6)	24.0 (20.1-28.2)
Saudi Arabia	23.1 (9.6-32.6)	23.3 (18.7-27.2)
Senegal	18.2 (8.4-26.0)	18.3 (15.0-21.3)
Serbia	25.4 (11.7-37.9)	29.0 (23.9-34.1)
Seychelles	23.5 (9.5-34.4)	24.4 (19.8-28.6)
Sierra Leone	17.1 (9.7-24.9)	16.9 (14.4-20.0)
Singapore	19.3 (6.4-29.9)	23.3 (18.6-27.7)

Slovakia	28.8 (14.8-39.5)	32.0 (26.7-36.5)
Slovenia	26.6 (12.8-39.3)	30.8 (25.7-36.2)
Solomon Islands	24.6 (11.2-34.8)	24.3 (19.8-28.5)
Somalia	18.3 (7.9-26.5)	18.0 (14.5-21.3)
South Africa	14.9 (6.6-21.1)	15.3 (12.4-17.8)
Korea, Republic of	16.9 (6.4-26.7)	21.4 (17.6-25.2)
South Sudan	15.7 (6.0-22.6)	15.5 (12.3-18.1)
Spain	22.9 (10.4-35.4)	26.3 (22.0-31.2)
Sri Lanka	27.9 (14.4-38.8)	27.4 (22.7-31.7)
Sudan	25.8 (12.8-36.5)	25.9 (21.1-30.4)
Suriname	21.3 (9.2-32.3)	22.3 (18.3-26.4)
Swaziland	16.3 (8.1-22.7)	16.4 (13.5-18.9)
Sweden	27.3 (11.4-40.8)	31.5 (25.8-37.1)
Switzerland	27.2 (12.9-39.6)	31.9 (26.9-36.9)
Syrian Arab Republic	20.9 (10.8-29.5)	20.6 (16.8-24.3)
Taiwan, Province of China	16.0 (6.0-25.1)	18.1 (14.6-21.7)
Tajikistan	29.2 (14.1-41.3)	29.7 (24.2-34.8)
Tanzania, United Republic of	17.2 (7.8-24.7)	16.8 (13.6-19.8)
Thailand	20.8 (5.4-32.3)	24.1 (19.3-28.4)
Bahamas	21.3 (8.5-31.4)	22.5 (17.9-26.7)
Gambia	20.7 (9.7-29.5)	21.3 (17.5-24.8)
Timor-Leste	24.6 (8.8-36.6)	26.1 (21.0-30.7)
Togo	16.5 (7.4-24.6)	16.8 (13.7-20.0)
Tonga	29.3 (14.7-41.6)	29.8 (24.8-34.7)
Trinidad and Tobago	23.3 (11.7-33.1)	22.7 (18.4-26.8)
Tunisia	22.0 (10.5-32.9)	22.6 (18.2-27.1)
Turkey	20.5 (7.9-31.3)	21.9 (17.4-26.2)
Turkmenistan	33.0 (16.6-46.3)	33.3 (27.4-38.9)
Uganda	14.8 (6.5-22.0)	14.5 (11.8-17.3)
Ukraine	28.6 (13.5-40.4)	29.8 (23.9-35.0)
United Arab Emirates	20.0 (8.3-29.1)	20.1 (15.8-23.9)
United Kingdom	25.3 (11.6-37.5)	29.4 (24.6-34.3)
United States	25.8 (11.8-38.7)	28.1 (23.1-33.3)
Uruguay	25.5 (8.7-38.1)	29.6 (23.9-34.7)
Uzbekistan	32.1 (17.7-44.0)	31.4 (26.0-36.6)
Vanuatu	29.0 (11.0-40.9)	29.0 (23.0-33.7)
Venezuela, Bolivarian Republic of	21.2 (9.3-29.9)	21.6 (17.5-25.0)
Viet Nam	19.7 (5.4-30.4)	22.9 (18.2-26.9)
Yemen	25.3 (14.3-35.2)	25.9 (21.8-30.2)
Zambia	15.6 (7.5-22.4)	15.2 (12.5-17.8)
Zimbabwe	16.1 (8.3-22.2)	16.1 (13.3-18.5)

Abbreviation: PAF, population attributable fraction.

<sup>1</sup> Values were population attributable fractions (95% confidence interval) calculated based on comparison in Alternate Healthy Eating Index between global diet in 2017 and the reference healthy Diet.

<sup>2</sup> PAFs were calculated as the percentage of preventable total deaths in total deaths, including those due to infection and injury in the denominator.

<sup>3</sup> PAFs for total mortality were calculated based on the biological effects (risk ratios) for total deaths (deaths due to injury and infection excluded) from the Nurses' Health Study and the Health Professionals Follow-Up Study.

**Supplemental Table 6.** Percentage reductions in deaths as a result of improvements in the Alternate Healthy Eating Index from the current diet to the reference healthy die in men and women aged 25 years or older in 190 countries/ territories in 2017 in the sensitivity analysis using biological effects with further adjustment for body mass index. <sup>1</sup>

	Male	Female	Both sexes
<b>Total deaths <sup>2</sup></b>			
Preventable deaths	6,978,411 (5,768,476 - 8,100,019)	6,155,713 (5,142,120 - 7,100,753)	13,134,124 (10,910,597 - 15,200,773)
PAF (%)	26.2 (21.7, 30.4)	27.4 (22.9, 31.6)	26.8 (22.2, 31.0)
<b>Total deaths <sup>3</sup></b>			
Preventable deaths	6,380,068 (2,919,663 - 9,179,286)	5,595,643 (2,522,637 - 8,067,102)	11,975,711 (5,442,299 - 17,246,388)
PAF (%)	30.1 (13.8, 43.3)	29.6 (13.4, 42.7)	29.9 (13.6, 43.0)
<b>Cause-specific deaths</b>			
<b>Cancer</b>			
Preventable deaths	1,210,648 (548,606 - 1,795,445)	567,139 (104,135 - 982,269)	1,257,752 (632,772 - 1,683,166)
PAF (%)	21.5 (9.7, 31.9)	14.0 (2.6, 24.3)	18.4 (6.7, 28.7)
<b>Coronary heart disease</b>			
Preventable deaths	1,878,810 (1,261,245 - 2,425,734)	1,868,667 (1,240,652 - 2,410,745)	3,747,476 (2,501,897 - 4,836,478)
PAF (%)	32.3 (21.7, 41.8)	36.9 (24.5, 47.5)	34.4 (23.0, 44.5)
<b>Stroke</b>			
Preventable deaths	304,520 (-435,230 - 911,193)	683,834 (204,414 - 1,091,755)	988,354 (-230,817 - 2,002,948)
PAF (%)	9.7 (-13.9, 29.0)	23.1 (6.9, 36.8)	16.2 (-3.8, 32.8)
<b>Respiratory disease</b>			
Preventable deaths	964,393 (544,924 - 1,289,152)	975,823 (592,385 - 1,248,041)	1,940,217 (1,137,309 - 2,537,193)
PAF (%)	45.0 (25.5, 60.2)	56.5 (34.3, 72.2)	50.1 (29.4, 65.6)
<b>Neurodegenerative disease</b>			
Preventable deaths	446,211 (247,771 - 604,154)	93,638 (-301,194 - 426,993)	539,849 (-53,422 - 1,031,147)
PAF (%)	42.0 (23.3, 56.9)	5.2 (-16.7, 23.7)	18.9 (-1.9, 36.0)
<b>Kidney disease</b>			
Preventable deaths	258,156 (-21,509 - 434,609)	276,591 (87 - 433,594)	534,746 (-21,422 - 868,204)
PAF (%)	40.8 (-3.4, 68.7)	49.2 (0.0, 77.1)	44.7 (-1.8, 72.7)
<b>Diabetes</b>			
Preventable deaths	206,265 (126,597 - 275,809)	286,236 (231,689 - 335,270)	492,500 (358,286 - 611,079)
PAF (%)	31.6 (19.4, 42.3)	40.7 (32.9, 47.6)	36.3 (26.4, 45.1)
<b>Digestive system disease</b>			
Preventable deaths	806,709 (448,812 - 1,048,322)	451,042 (183,960 - 634,844)	1,257,752 (632,772 - 1,683,166)
PAF (%)	58.2 (32.4, 75.7)	49.7 (20.3, 70.0)	54.9 (27.6, 73.4)
<b>Injury (assumed)</b>			
Preventable deaths	0	0	0

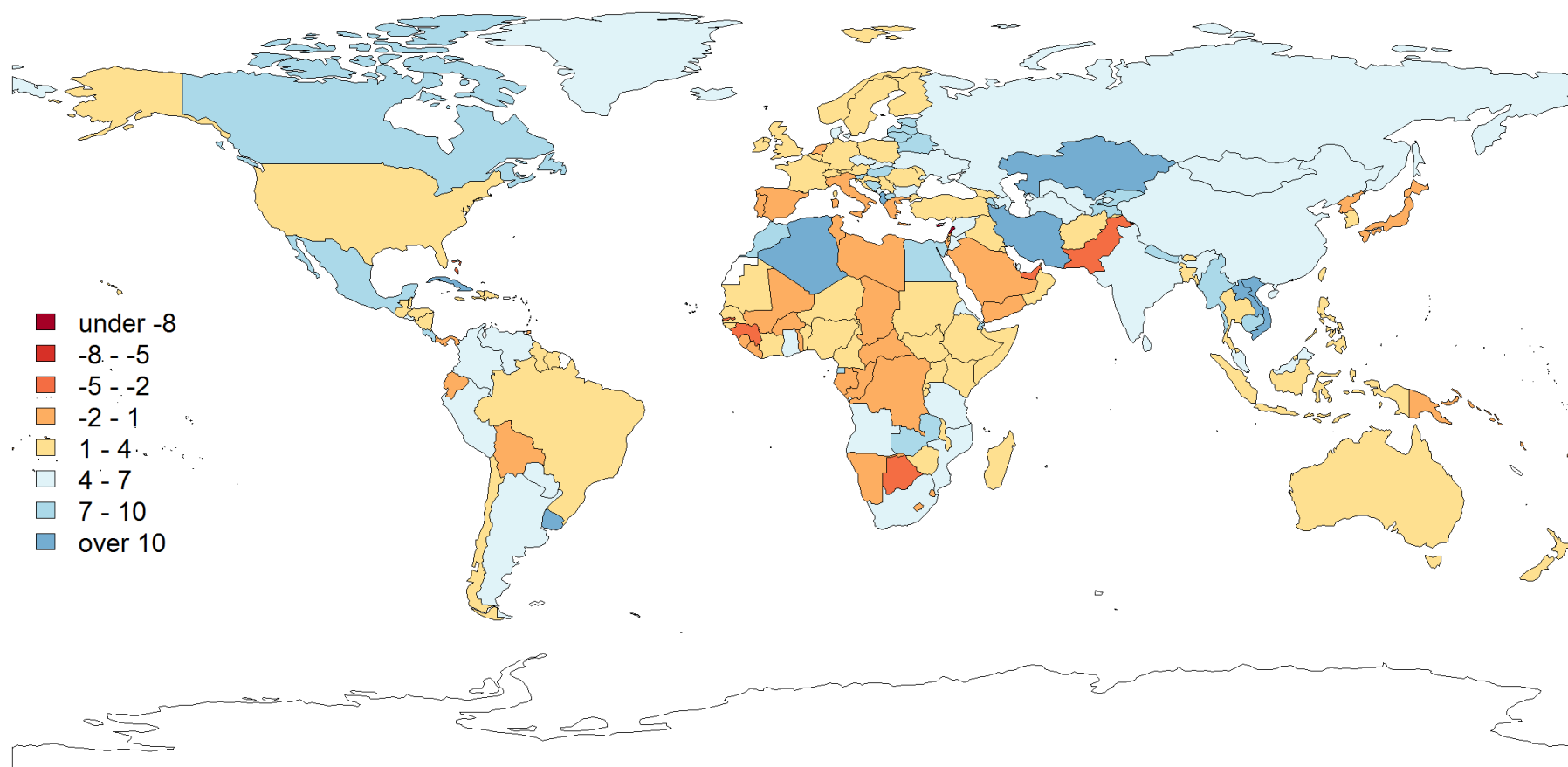
PAF (%)	0	0	0
<b>Infection (assumed)</b>			
Preventable deaths	0	0	0
PAF (%)	0	0	0
<b>Other causes</b>			
Preventable deaths	304,357 (198,446 - 394,869)	392,673 (266,509 - 503,590)	697,030 (464,955 - 898,459)
PAF (%)	40.2 (26.2, 52.2)	35.7 (24.2, 45.8)	37.5 (25.0, 48.4)

Abbreviation: PAF, population attributable fraction.

<sup>1</sup> Values were population attributable fractions (95% confidence interval) calculated based on comparison in Alternate Healthy Eating Index between global diet in 2017 and the reference healthy Diet.

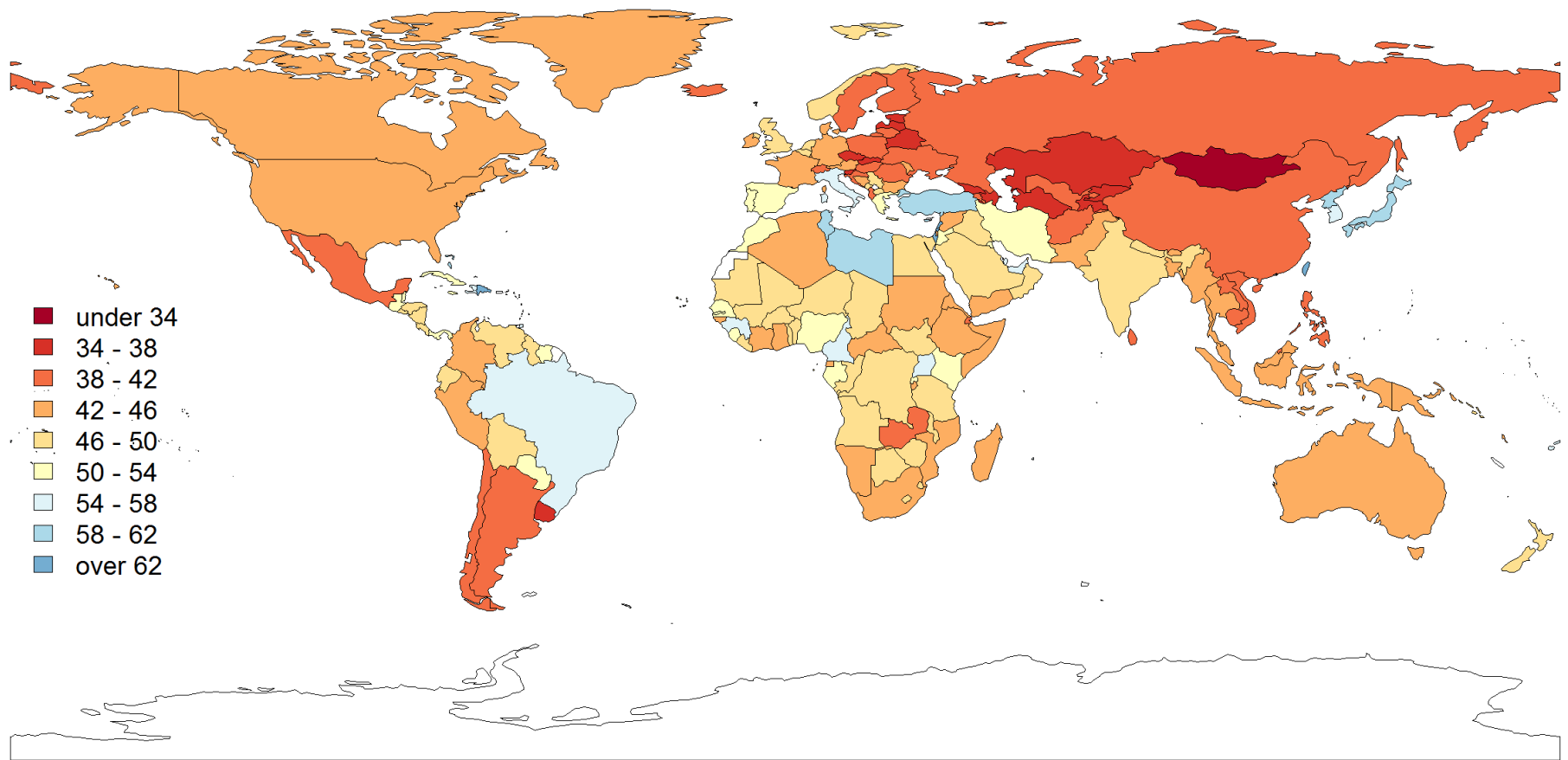
<sup>2</sup> Total preventable deaths were calculated by summing up all the preventable cause-specific deaths. PAFs were calculated as the percentage of preventable total deaths in total deaths, including those due to infection and injury in the denominator.

<sup>3</sup> PAFs for total mortality were calculated based on the biological effects (risk ratios) for total deaths (deaths due to injury and infection excluded) from the Nurses' Health Study and the Health Professionals Follow-Up Study. Preventable total deaths were calculated by multiplying the total deaths (deaths due to injury and infection excluded) by the PAFs. The final PAFs for total mortality were calculated as the percentage of preventable total deaths in total deaths, including those due to infection and injury in the denominator.



**Supplemental Figure 1.** Geographical distribution of changes in Alternate Healthy Eating Index from 1990 through 2018 in men and women aged 25 years or older in 190 countries/ territories. White areas indicate that dietary data were not available.





**Supplemental Figure 2.** Geographical distribution of Alternate Healthy Eating Index in men and women aged 25 years or older in 190 countries/ territories in 1990.

White areas indicate that dietary data were not available.

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