The Relative Health Burden of Selected Social and Behavioral Risk Factors in the United States: Implications for Policy

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Objectives. We sought to quantify the potential health impact of selected medical and nonmedical policy changes within the United States.

Methods. Using data from the 1997–2000 National Health Interview Surveys (linked to mortality data through 2002) and the 1996–2002 Medical Expenditure Panel Surveys, we calculated age-specific health-related quality-of-life scores and mortality probabilities for 8 social and behavioral risk factors. We then used Markov models to estimate the quality-adjusted life years lost.

Results. Ranked quality-adjusted life years lost were income less than 200% of the poverty line versus 200% or greater (464 million; 95% confidence interval [CI]=368, 564); current-smoker versus never-smoker (329 million; 95% CI=226, 382); body mass index 30 or higher versus 20 to less than 25 (205 million; 95% CI=159, 269); non-Hispanic Black versus non-Hispanic White (120 million; 95% CI=83, 163); and less than 12 years of school relative to 12 or more (74 million; 95% CI=52, 101). Binge drinking, overweight, and health insurance have relatively less influence on population health.

Conclusions. Poverty, smoking, and high-school dropouts impose the greatest burden of disease in the United States. (*Am J Public Health.* 2010;100:1758–1764. doi:10.2105/AJPH.2009.165019)

Heart disease, cancer, and stroke are the leading causes of death in the United States and much of the world. These deaths arise in part from behavioral risk factors such as smoking, obesity, and excessive alcohol use and in part from social risk factors, such as income and education disparities.[1–4] Social risk factors also affect population health.[5,6] However, although public health policy has been directed at individual social and behavioral risks, there has been little systematic investigation of their relative contribution to US population health.

Building on prior research,[7–10] we examined social risk in the context of health disparities resulting from an individual's membership in a socially identifiable and disadvantaged group compared with membership in a nondisadvantaged counterpart.[11] The poor health outcomes of such groups has long been linked, in part, to differential access to everyday social goods, including access to medical care, transportation, housing, and disability insurance.[4,12] Social risk factors affect health through a wide array of pathways including stress, discrimination, social exclusion, environmental exposures, and health behaviors.[3,13–17]

We examined the potential health gains associated with selected policy goals that are at the forefront of the current national debates. These include smoking prevention, increased access to medical care, poverty reduction, and early childhood education programs targeted toward increasing high school graduation rates. To contextualize these findings, we also explored some of the priority areas from Healthy People 2010.[18] We focused on specific policies. For example, we quantified the population health benefits of poverty reduction rather than the entire income gradient[19]; however, we did not attempt to estimate the population health impact of any 1 policy. Rather, we simply present the total burden of disease associated with each risk factor that targeted policies might address. The objective is to provide policymakers with a rough sense of how different policy priorities might influence population health.

METHODS

We estimated the burden of disease in the United States associated with race (non-Hispanic Black versus non-Hispanic White); income (<200% of the federal poverty line versus ≥200%); schooling (<12 years versus ≥12); and health insurance (none versus private). The selected behavioral risk factors we studied were smoking (current versus never); obesity (body mass index [BMI; weight in kilograms divided by height in meters squared] ≥30 kg/m^2 versus 20 kg/m^2 to 24.9 kg/m^2); overweight (BMI 25 kg/m^2 to 29.9 kg/m^2 versus 20 kg/m^2 to 24.9 kg/m^2); and binge drinking (≥5 drinks per day at least 1 day per year versus <5).

Datasets

We conducted all analyses by using consistent nationally representative datasets of the US noninstitutionalized population: the National Health Interview Survey (NHIS) linked both to the National Death Index and the Medical Expenditures Panel Survey (MEPS). We constructed mortality models with data from the 1997–2000 NHIS (157 809 adults aged 18 to 85 years) linked to mortality data via the National Death Index (1 904 535 person-years, 5749 deaths), with follow-up through the end of 2002 (the most recent follow-up publicly available).[20,21] This linkage is achieved via participant identifiers within the NHIS (e.g., their social security number), and permits prospective follow-up of mortality data. The 1 exception was the insurance analysis, for which we used 1996–2000 MEPS data because the MEPS contains more detailed information than the NHIS. We exploited the MEPS linkage to the NHIS to obtain mortality follow-up through the end of 2002.

We constructed health-related quality-of-life (HRQL) models by using the EuroQol (EQ-5D) from the 2000–2002 MEPS with US weights (38 305 adults).[22,23] The EQ-5D is a 5-item preference-based HRQL measure where participants rate their problems with mobility, self-care, usual activities, pain or discomfort, and anxiety or depression with a 3-category scale (no problems, some problems, extreme problems). This score is translated into a value ranging from zero (equivalent to death) to 1 (equivalent to perfect health).

The MEPS is a subsample of NHIS respondents, so the 2 surveys can be linked.[24] Persons were eligible for inclusion in these analyses if they were aged 18 years or older. There was no upper age limit except for the insurance analysis, which ran to age 65 (the age at which almost all persons become insured through Medicare).

Risk Factor Selection

Our choice of risk factors was guided by the published literature[1,19,25–29] but limited by data available in both NHIS and MEPS.

Behavioral risk factors. We identified smoking, obesity, overweight, and alcohol misuse as 4 important behavioral risk factors.[1,26,29] Because we lacked reliable measures of alcohol dependence in our data, we substituted binge drinking to at least capture some of the risk. Other behavioral risk factors such as exercise level, sexual behavior, and the use of illicit drugs either appear to have less impact or there were inadequate data for estimation.

Social risk factors. The most studied social factors are those related to socioeconomic status and race, which appear to have powerful independent effects on mortality.[17,30–33] We also included absence of health insurance as a social risk factor. Although having health insurance may also be viewed as a mediator of social risk rather than a social risk factor itself, it shares many common characteristics of social risk factors, including being largely shaped by social policy and strongly clustering with other social risk factors.[34] Occupation also shapes health both indirectly through income and directly through social status, social networks, occupational hazards, stress, agency, and behavioral norms. However, unlike education and income, there are no generally accepted ordinal (or dichotomous) measures in the available data that fully capture these disparate aspects of occupational risk, so we did not examine it.

Risk Factor Thresholds

We developed a series of dichotomous thresholds to compare individuals with the risk factor present to those with no risk factor present. Thresholds were primarily chosen based upon the potential health benefits associated with current policy goals.

Most social programs aimed at addressing income disparities in the United States are targeted toward poverty alleviation. These include earned income tax credits, school lunch programs, and Medicaid. Most programs vary by state, but are targeted to those earning less than 200% of the federal poverty line.[35–37] Thus, we used less than 200% relative to 200% or more of the poverty line, per 2000 Census definitions obtained via the MEPS, as a threshold.

Most education programs are geared toward improving high-school graduation.[38] We therefore chose the threshold for educational attainment (less than 12 years versus 12 years or more) based on whether individuals possessed a high school diploma, as it is the basic social credential needed for employment.

The smoking analysis compared current smokers with never smokers. Former smokers were excluded because many have quit only after developing serious underlying disease, and in the cross-sectional data available their mortality and HRQL were worse than that of current smokers.

The overweight (BMI $\geq$25 kg/m^2 to 29.9 kg/m^2) and obesity (BMI $\geq$30 kg/m^2) analyses used standard thresholds.[39] However, we used normal BMI ($\geq$20 kg/m^2 to 24.9 kg/m^2) as our reference rather than BMI from 18.5 kg/m^2 to 24.9 kg/m^2 to ensure that we did not include chronically ill persons (who are prevalent in the 18.5 kg/m^2 to 19.9 kg/m^2 range) in the reference group.[40] This analysis reflects the potential health benefits associated with overweight and obesity prevention.

The race analyses compared non-Hispanic Blacks with non-Hispanic Whites. African Americans have the worst life expectancy of any major minority group. We conducted 2 analyses, first without controlling for income and education and then again controlling for these factors. The former analysis may be useful for estimating the health benefits associated with community-targeted education interventions, such as Head Start or reduced class size programs. The latter analysis is meant to estimate the health benefits associated with antidiscrimination policies.

The health insurance analysis compared those with no coverage for 12 months in the survey year with those having 12 months of private coverage. We excluded those on public health insurance because these persons often have severe medical morbidity or disabilities complicating the assessment of health insurance effects. This analysis helps estimate the potential health benefits associated with universal health insurance.

The binge drinking analysis was constrained by the available data to comparing those drinking 5 or more drinks per day at least 1 day per year with those drinking less. This analysis helps estimate the potential health benefits associated with either community- or office-based anti–binge drinking programs.

Outcome Measure

To assess relative effects of social and behavioral risk factors on population health, we used quality-adjusted life years (QALYs), which capture both morbidity and mortality in a single metric. The QALY is capable of comparing disparate conditions, such as depression and stroke, or effects of disparate risk factors.[41] Central to the QALY is the HRQL score, here measured as the EQ-5D.[42]

Regression Analyses

We conducted regression analyses with Stata version 10.1 (Statacorp, College Station, TX), adjusting for the complex survey designs of the NHIS and MEPS. We estimated risk factor stratified regression models separately for mortality and for HRQL. Confidence intervals for estimated regression coefficients were adjusted for the survey design and were based on the linearized (robust) variance estimator.

To derive the age-specific mortality risks and HRQL scores, we used the sample of participants with the risk factor present as a standard population as follows. First, we estimated regression coefficients from a pair of mortality and HRQL regression analyses of the datasets involving only persons with the risk factor present. From these regression analyses, we generated age-specific mortality rates and HRQL scores for the “risk factor present” condition. Second, we estimated regression coefficients from mortality and HRQL regression analyses involving only those with the risk factor absent. We then applied the regression coefficients from the analyses of those with the risk factor absent to the covariate values of those with the risk factor present to predict the

TABLE 1—Covariates Used for Each Risk Factor Regression Model for Estimating the Impact of Common Social and Behavioral Risk Factors on US Population Health: 1997–2000 National Health Interview Survey Followed Through 2002

Risk Factor Model	Covariates
< 12 years schooling	Base, race/ethnicity
< 200% of federal poverty line	Base, race/ethnicity
< 200% of federal poverty line[a]	Base, race/ethnicity, education
Non-Hispanic Black	Base
Non-Hispanic Black[b]	Base, income, education
No health insurance	Base, race/ethnicity, income, education
Smoking	Base, race/ethnicity, income, education
Obesity[c]	Base, race/ethnicity, income, education, smoking status
Overweight	Base, race/ethnicity, income, education, smoking status
Binge drinking[d]	Base, race/ethnicity, income, education, smoking status

Notes. Base covariates were age, log age, region, survey year. Race/ethnicity was categorized as non-Hispanic White, non-Hispanic Black, Hispanic, Asian. Income categories were < 100%, 100% to 124%, 125% to 199%, 200% to 399%, ≥ 400% of federal poverty line. Education categories were < 12 years, 12 years, 13 to 15 years, 16 years, > 16 years schooling completed.

[a]Per 2000 Census definitions obtained via the MEPS. The poverty analysis was conducted twice, once with and once without education included as a covariate to isolate the effects of adult income programs and childhood intervention programs.

[b]The race analysis was conducted twice, once with and once without income and education added as covariates to isolate the burden of disease associated with childhood intervention programs and anti–racial discrimination programs, respectively.

[c]Defined by body mass index (BMI; weight in kilograms divided by height in meters squared). Obesity indicated by BMI ≥ 30 kg/m^2.

[d]Defined as more than 5 or more drinks per day at least 1 day per year.

corresponding counterfactual ("risk factor absent") age-specific mortality rates and HRQL scores.

We adjusted all regression models for a base set of covariates: age, log age (to address nonlinear age effects), gender, region of the country (Northeast, South, Midwest, West), and survey year (as a series of dummy variables). When included as covariates, we measured income and educational attainment with 5 categories each (<100%, 100% to 124%, 125% to 199%, 200% to 399%, and ≥400% of the federal poverty level; and <12 years, 12 years, 13 to 15 years, 16 years, and >16 years of schooling completed), and race/ethnicity was measured as 4 categories (non-Hispanic White, non-Hispanic Black, Hispanic, or Asian). See Table 1 for a listing of variables included as covariates in each analysis.

We estimated mortality regression coefficients with a multiplicative hazards parametric regression model of age-at-event failure time data, specified as a log-linear model by using Poisson regression.[43,44] To better estimate the impact of time-varying age on the baseline hazard, this model used person-years as the unit of analysis, with each participant contributing an observation for each full or partial year of follow-up. A person-year observation could represent only a partial-year of follow-up because of the timing of death relative the NHIS interview. We used standard methods in the Poisson regression model to account for differences in observation lengths.[44,45] We estimated HRQL regression coefficients with a survey weighted least squares linear regression model with EQ-5D scores as the dependent variable.

Markov Cohort Models

We used Markov cohort models to compute the expected QALYs gained when risk factors are removed from the US population. The models used our regression-derived mortality probabilities and mean HRQL scores (in 1-year age intervals) as inputs. We ran models to age 85 years. We also ran them to age 65 years to (1) provide prime-of-life estimates, (2) facilitate comparisons with the insurance analysis (which also ran only to age 65 years), and (3) explore survivor effects.

During each 1-year cycle, the age-specific mortality risk was used to transition participants to the "dead" state beginning at the next cycle, at which point they exited the model with all subsequent HRQL scores set to zero. The remaining participants were assigned to the "alive" state and received the HRQL score for the next age (based on the appropriate age and risk-factor–specific HRQL score input parameter). No discounting was applied to our estimates to ensure comparability with other burden of disease study methodology. All Markov models were built with DATApro 2006 (TreeAge Software, Williamstown, MA).

We estimated the overall societal health impact by multiplying the incremental differences in quality-adjusted life expectancy in QALYs by the number of adults in the United States at risk to obtain total QALYs lost associated with the risk factor.

We used the 95% confidence intervals around each age-specific HRQL and mortality parameter estimate to derive 95% Monte Carlo confidence intervals for each estimate of QALYs lost associated with a given risk factor. Each distribution was sampled 100 times per trial, and 1000 trials were run for each analysis. The final output for each model was normally distributed.

RESULTS

Sample sizes, population proportions, and person-years of follow-up are shown in Table 2. The mean age of the sample was 46.3 years (standard error [SE] = 0.14), with 55.4% (SE = 0.2) women. The mean EQ-5D score was 0.87 (SE = 0.001).

Table 3 presents the quality-adjusted life expectancy at age 18 years with and without the risk factor alongside rankings of the incremental health impact (the gains associated with eliminating the risk) of each risk factor over the lifespan of the average American. On average, living at less than 200% federal poverty level showed the greatest impact on health, resulting in a net loss of 8.2 QALYs per person exposed. Smoking was second, with 6.6 QALYs lost per person over his or her lifetime. These were followed by the following risk factors in rank order: less than 12 years of school, being non-Hispanic Black, obesity, binge drinking, lack of health insurance, and overweight. When modeling was truncated at age 65 years, smoking dropped in ranking.

Table 4 presents estimates of the US burden of disease associated with each risk factor. This

TABLE 2—Sample Sizes, the Percentage of Persons Within Each Risk Category, and Person-Years at Risk for Mortality Used in Our Analyses (Through Age 85 Years): 1997–2000 National Health Interview Survey Followed Through 2002

Risk Factor	Person-Years at Risk for Mortality			HRQL, No.
	No.	% (SE)[a]	Person-Years[b]	
Race				
Non-Hispanic Black	17 075	11.8 (0.2)	57 103	6259
Non-Hispanic White	83 663	75.9 (0.3)	287 696	27 583
Education				
< High school	26 672	18.4 (0.2)	88 120	4986
≥ High school	97 121	81.6 (0.2)	338 946	39 881
Poverty				
< 200% poverty line	36 345	32.7 (0.3)	153 158	15 558
≥ 200% poverty line	64 345	67.3 (0.3)	273 908	29 718
Health insurance				
None	8609	14.6 (0.4)	35 104	7684
Private insurance	28 985	65.0 (0.6)	121 499	30 381
Smoker				
Current	29 936	24.6 (0.2)	106 707	9067
Never	65 957	52.3 (0.2)	224 818	31 556
BMI, kg/m^2				
Normal (20 to 24.9)	44 477	37.8 (0.2)	124 144	10 812
Overweight (25 to 29.9)	42 251	34.6 (0.2)	109 949	12 189
Obese (≥ 30)	25 579	20.2 (0.2)	66 134	8840
Binge drinking				
≥ 5 drinks per d	23 800	24.5 (0.2)	72 725	777
< 5 drinks per d	78 065	75.5 (0.2)	211 074	2806

Notes. BMI = body mass index; HRQL = health-related quality of life. Sample sizes for HRQL scores are from the 2000–2002 Medical Expenditure Panel Survey.
[a]Percentages are population (not sample) percentages; some percentages do not add to 100 because those with risk factor and their comparison group do not represent the whole population.
[b]Person-years = person-years of follow-up in mortality analysis.

analysis takes into account both the average impact on individuals and the number of individuals exposed. Here, poverty was again the leading risk factor, resulting in 544 million QALYs lost (range = 434 million to 666 million). Smoking was again second, at 332 million QALYs lost (range = 246 million to 415 million). Having less than 12 years of education was again third, followed by being obese, being non-Hispanic Black, binge drinking, being overweight, and being uninsured. The Monte Carlo confidence intervals for the estimates for no health insurance and overweight overlap with zero, indicating the effects were not statistically significant. In the analyses through age 65 years, poverty was again the leading risk factor, with other rankings largely unchanged.

DISCUSSION

There is debate over the extent to which health policies should be directed at broader social risk factors (such as race, education, poverty, and health insurance) relative to narrower, intermediate, and behavioral risk factors (such as smoking, obesity, and alcohol consumption).[32,46] Although there is substantial overlap, the former are generally addressed by nonmedical social policies, some of which are controversial in the US context, and the latter via the public health and medical systems.[27] One missing piece of information in this debate is the relative extent to which these major risk factors impact population health. Numerous studies have examined the impact of behavioral and social risk factors on health,[17,30,31,47–52] but this is the first study to examine these together by using a consistent analytic approach applied to the same set of nationally representative data.

We found that living at less than 200% of the federal poverty level reduced quality-adjusted life expectancy more than any other risk factor, even after we controlled for effects of education. However, smoking also proved to be a major contributor to population health, outweighing the overall impact of less than 12 years of schooling and being non-Hispanic Black. The individual impacts on QALYs of living at less than 200% of the federal poverty level, failing to graduate from high school, and being non-Hispanic Black were each greater than that of obesity. However, on a population level, the high prevalence of obesity renders it the fourth largest public health problem we, falling behind being poor, a smoker, or a high school dropout in importance. The relatively small impact of schooling in our analyses was surprising, and may reflect the declining health-related significance of high-school graduation, effects of social grade promotion, and inclusion of those with general equivalency diplomas.

Our analysis captured age-related differences in mortality; used consistent, nationally representative data sources that captured relevant confounders; used predictive modeling; and included measures of morbidity. The primary limitation was that risk factor categories are not entirely independent, but rather overlap in complex ways. For instance, low-income persons are more likely to smoke, so the smoking analysis will capture some income effects. To address this limitation, we introduced control variables into our models. However, it is likely that other unadjusted confounders may have biased our findings.

Confounding was also a challenge in our smoking and drinking analyses. Those with either of these risk factors may be more likely to engage in other risk-taking behaviors for which we were not able to account. Thus, our estimates of the burden of disease associated with these factors may be overstated. Other unmeasured confounders, such as genetic factors or personality profiles, may also have resulted in overestimates of the burden of disease reported here.

TABLE 3—Quality-Adjusted Life Expectancy at Age 18 for Persons With and Without Each Risk Factor Under Study, and Incremental Quality Adjusted Life-Years (QALYs) Lost by Age 65 or 85 Years: 1997–2000 National Health Interview Survey Followed Through 2002

Risk Factor	QALYs From Age 18 to 65 Years, Mean (SD)	Incremental QALYs Lost to Age 65 Years, Mean	QALYs From Age 18 to 85 Years, Mean (SD)	Incremental QALYs Lost to Age 85 Years, Mean
Poverty				
≥200% poverty line	41.2 (0.6)		52.9 (1.2)	
<200% poverty line	36.8 (0.7)	4.5	44.7 (1.2)	8.2
Smoker[a]				
Never	40.1 (0.6)		50.9 (1.1)	
Current	37.4 (0.7)	2.7	44.2 (1.1)	6.6
Poverty adjusted for education				
≥200% poverty line	40.1 (0.6)		51.0 (1.1)	
<200% poverty line	36.7 (0.7)	3.4	44.7 (1.1)	6.4
Education				
≥High school	40.1 (0.6)		50.8 (1.1)	
<High school	37.8 (0.7)	2.2	45.8 (1.2)	5.1
Race				
Non-Hispanic White	40.2 (0.6)		50.9 (1.1)	
Non-Hispanic Black	38.4 (0.7)	1.8	46.2 (1.2)	4.7
Obesity[b]				
Normal (BMI = 20 to 24.9 kg/m^2)	40.6 (0.6)		52.2 (1.1)	
Obese (BMI ≥ 30 kg/m^2)	38.2 (0.6)	2.4	48.0 (1.1)	4.2
Race adjusted for income, education[a]				
Non-Hispanic White	38.8 (0.6)		48.0 (1.1)	
Non-Hispanic Black	38.3 (0.7)	0.5	46.3 (1.2)	1.7
Binge drinking[b]				
<5 drinks per d	40.2 (0.7)		50.5 (1.2)	
≥5 drinks per d	39.6 (0.6)	0.62	49.3 (1.1)	1.2
Health insurance[a]				
Private insurance	40.0 (0.7)		...	
None	39.4 (0.6)	0.6	...	...
Overweight[b]				
Normal (BMI = 20 to <25 kg/m^2)	40.9 (0.6)		52.7 (1.2)	
Overweight (BMI = 25 to 29.9 kg/m^2)	40.4 (0.6)	0.5	52.4 (1.2)	0.3

Note. BMI = body mass index. All regressions adjusted for age, log age, gender, race/ethnicity (except race model), region of residence (Northeast, South, Midwest, West), and survey year.
[a]Adjusted for poverty (<100%, 100% to 124%, 125% to 199%, 200% to 399%, ≥400% of the federal poverty level) and education levels (<12 years, 12 years, 13 to 15 years, 16 years, >16 years of schooling completed).
[b]Adjusted for poverty, education levels, and smoking status.

A further limitation is that policy solutions aimed at addressing the burden of disease associated with earning less than 200% of the poverty line are less than clear because the income–health relationship is bidirectional.[53] Poverty produces a wide array of risk factors (e.g., crime, poor housing, limited access to medical care) thereby damaging the health and longevity of low-income populations. But sickness also leads to unemployment and poverty. The policy implications for these 2 pathways differ. Poverty itself might be addressed through policies that minimize inequalities in schooling (e.g., through early intervention programs) or through the Earned Income Tax Credit.[52,53] In contrast, to address the effect of health on income, policies such as universal health insurance and disability insurance would better stem the loss of income among those who are poor because they are sick.[54,55] Likewise, our health insurance analysis was designed to detect potential benefits associated with improved access to medical care. However, health insurance would also protect health by reducing income shocks associated with illness; health care costs are a leading cause of home foreclosure.

Differences in the follow-up interval for mortality estimates, the time intervals over which the risk factors are captured, and regression model design (e.g., treating inputs as moderators versus mediators) also affect our estimates of population health impact of the risk factor under study. Risk factor status was assessed at baseline only, so that misclassification over time would produce biased estimates. This bias was somewhat reduced by the short follow-up interval. However, the risk factors we estimated were of a similar magnitude to those in the medical literature.[17,30,31,47–52]

We were only able to explore the limited range of socio–behavioral risk factors available in the datasets we used. As with other burden of disease studies, our estimates can only serve as guideposts for policymakers; the policies we identify will not eliminate the risk factor in the population. Conversely, policies can have spillover effects. For example, the overall income–health gradient is much larger than the poverty gradient,[19] so spillover effects from poverty reduction programs could produce larger gains. Finally, inputs were self-reported.

Others have shown that intermediate causes of deaths—behavioral risk factors, microbial agents, toxic agents, motor vehicle accidents, and firearms—account for more than half of all the deaths in the United States.[1,29] We extend these earlier analyses to include measures of morbidity and key social determinants of health. We find that living at less than 200% of the federal poverty level imposes a greater societal health burden than either of the leading behavioral causes of death—tobacco and obesity. Consistent with this, the original planning committee for Healthy People 2010 strongly considered including poverty and educational attainment among its leading indicators.[56] Our findings provide additional justification for including social determinants in Healthy People 2020 and may help inform priority setting aimed at optimizing population health. ■

TABLE 4—The Impact of Selected Social and Behavioral Risk Factors on Millions of Quality-Adjusted Life Years (QALYs) Lost in the United States: 1997–2000 National Health Interview Survey Followed Through 2002

Risk Factor	Impact to Age 65 Years, Millions of QALYs (95% CI)	Impact to Age 85 Years, Millions of QALYs (95% CI)
< 200% poverty line	226 (182,276)	544 (434, 666)
< 200% poverty line adjusted for education	171 (128, 223)	421 (315, 537)
Current smoker [a]	129 (92,167)	332 (246, 415)
< High-school education	56 (35, 80)	190 (134, 259)
Obesity (BMI ≥ 30 kg/m^2)[b]	100 (81, 131)	149 (115,193)
Non-Hispanic Black race	40 (21,59)	113 (78, 153)
Binge drinking[bc]	29 (3, 67)	56 (15, 118)
Non-Hispanic Black race[a]	13 (-2, 32)	42 (13, 83)
Overweight (BMI ≥ 25 kg/m^2 to 29.9 kg/m^2)[b]	20 (-24, 42)	35 (10,45)
Uninsured[a]	11 (-15, 29)	. . .

Note. BMI = body mass index. All regressions adjusted for age, log age, gender, race/ethnicity (except race model), region of residence (Northeast, South, Midwest, West), and survey year.

[a]Adjusted for poverty (< 100%, 100% to 124%, 125% to 199%, 200% to 399%, ≥ 400% of the federal poverty level) and education levels (< 12 years, 12 years, 13 to 15 years, 16 years, > 16 years of schooling completed).

[b]Adjusted for poverty, education levels, and smoking status.

[c]Defined as 5 or more drinks per day at least 1 day per year.

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Contributors

P. Muennig led the article development and conducted the Markov model analyses. K. Fiscella helped develop the policy model and contributed to article development. D. Tancredi provided expert input on the development and refinement of the regression models and contributed to article development. P. Franks co-led the article development and led the development of regression models.

Human Participant Protection

This study used only anonymous nationally representative datasets and no additional institutional review board approval was needed.

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