

Lifetime Risk for Sudden Cardiac Death in the Community

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Background—Sudden cardiac death (SCD) is a leading cause of death in the United States and often occurs without previous cardiac symptoms. Lifetime risk for SCD and the influence of established risk factors on lifetime risks for SCD have not been estimated previously.

Methods and Results—We followed Framingham Heart Study participants who were free of cardiovascular disease before their earliest examination. SCD was defined as death attributed to coronary heart disease within 1 hour of symptom onset without another probable cause of death, as adjudicated by a panel of 3 physicians. Lifetime risk for SCD was estimated to 85 years of age for men and women, with death attributed to other causes as the competing risk, and stratified by risk factor levels. We followed 2294 men and 2785 women for 160 396 person-years; 375 experienced SCD. At 45 years of age, lifetime risks were 10.9% (95% CI, 9.4–12.5) for men and 2.8% (95% CI, 2.1–3.5) for women. Greater aggregate burden of established risk factors was associated with a higher lifetime risk for SCD. Categorizing men and women solely by blood pressure levels resulted in a clear stratification of lifetime risk curves.

Conclusions—We present the first lifetime risk estimates for SCD. Greater aggregate risk factor burden, or blood pressure level alone, is associated with higher lifetime risks for SCD. This high risk of premature death attributed to SCD (approximately 1 in 9 men and 1 in 30 women) should serve as a motivator of public health efforts in preventing and responding to SCD. (*J Am Heart Assoc.* 2016;5:e002398 doi: 10.1161/JAHA.115.002398)

Key Words: death • epidemiology • risk factors • sudden

Sudden cardiac death (SCD) is a leading cause of death in the United States, with incidence estimated to be between 180 000 and 450 000 per year.¹ SCD most commonly occurs in those with no previous overt symptoms of cardiovascular disease (CVD) and is an especially important cause of premature deaths.² Up to 25% of out-of-hospital sudden cardiac arrests occur in individuals who were asymptomatic before to the event.³ Most of those who experience SCD have underlying coronary heart disease (CHD), but other variables, such as environmental exposures and gene expression, have been shown to be associated with SCD events.^{3,4} A widely used SCD risk stratification method,

classifying based on ejection fraction, often misses patients who ultimately experience SCD, but a better method that accurately predicts patients who will experience SCD over a specified time frame does not exist.^{2,5} Therefore, improved understanding and prediction of those at risk for SCD is an important step in reducing deaths attributed to SCD.

Lifetime risk estimates for several types of CVD and total CVD have previously been reported.^{6–12} These studies have shown that those with optimal risk factor profiles, including simultaneous untreated optimal levels of blood pressure and total cholesterol, and absence of current smoking or diabetes mellitus, have a substantially lower overall lifetime risk for CVD compared with those with a greater aggregate risk factor burden. However, cumulative lifetime risk for SCD has not previously been estimated in any cohort. Lifetime risk estimation adjusts for competing risks of death, which becomes increasingly important in longer-term risk estimation given that the risk from other causes of death increases over time. The importance of establishing risk models composed of important, readily available clinical variables has recently been highlighted.⁵ The present study used individual participant data from the Framingham Heart Study (FHS) original cohort to estimate the remaining cumulative lifetime risk for SCD in men and women at index ages 45, 55, 65, and 75 years of

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age. We report overall cumulative lifetime risks for SCD by sex and also stratify by aggregate risk factor burden at each index age.

Methods

Participants

The Framingham Heart Study is a community-based prospective epidemiological study among 5209 men and women enrolled between the ages of 28 and 62 years in Framingham, Massachusetts. Participants have had medical history assessed, a physical examination, and laboratory tests every 2 years. The FHS's protocol and study design have been described elsewhere.¹³ Protocols and procedures were approved by the institutional review board of Boston Medical Center. Written informed consent was obtained from all participants. For the present study, we assessed all participants who were free of CVD before their earliest examination between 1948 and 2001 (exams 1–26) and who attended at least 1 examination between the ages of 40 and 94 years. Follow-up for vital status of the cohort has been essentially complete throughout the duration of the study.

Participants in the FHS underwent standardized anthropometric measurements for height and weight. Current smoking was defined as self-report of active smoking within the last year before the examination. Blood pressure was the average of 2 separate readings taken by a physician at least 5 minutes apart, as described previously.¹⁴ Blood was drawn in EDTA plasma for all cholesterol measurements, as previously described.¹⁵ Diabetes mellitus was defined as the use of insulin or hypoglycemic agents or a casual blood glucose ≥ 11 mmol/L (≥ 200 mg/dL). We included 4 risk factors: systolic/diastolic blood pressure, total cholesterol, current smoking status, and diabetes mellitus diagnosis to stratify participants according to the mutually exclusive aggregate risk factor burden strata defined in Table 1. Past CVD history was defined as having a nonfatal myocardial infarction, nonfatal stroke, or a congestive heart failure diagnosis before

the examination used for each participant at the selected index age.

Case Ascertainment

Our primary outcome of interest was SCD, defined, as published previously, as a death attributed to CHD within 1 hour of symptom onset with no other probable cause of death suggested from the medical record.¹⁶ The cause of death was assessed by a review to determine whether symptoms were present and the duration of the symptoms before death. To determine the duration of symptoms, various methods, including next-of-kin interviews, primary physician records, and hospital records, were used. Any unwitnessed deaths or those for which the time between symptom onset and death was more than 1 hour were excluded from an SCD categorization. All suspected sudden death events were reviewed and adjudicated by a panel of 3 trained physicians who applied established criteria for such events.^{16,17}

Statistical Analysis

All statistical analyses were performed using SAS statistical software (version 9.3; SAS Institute Inc., Cary, NC). We classified each eligible participant exam record by age into index ages of 45, 55, 65, and 75, where each index age category included data obtained within 5 years of the index age. If participants had multiple exams within a given index age stratum, only the first record was included. In addition, all participants were stratified by aggregate risk factor burden (as described above) at each index age for which they attended an examination, separately for men and women.

We used a modified form of Kaplan–Meier analysis, which accounts for competing risks from causes other than SCD, to avoid overestimating lifetime risk, as described in detail previously.^{6,18} Briefly, the adjusted Kaplan–Meier analysis counts deaths attributed to causes other than SCD as a separate event, not as a censoring event as occurs in unadjusted Kaplan–Meier analysis. The cumulative risk for

Table 1. Aggregate Risk Factor Burden Strata Definitions

	Systolic/ Diastolic BP (mm Hg)		Total Cholesterol (mg/dL)		Diabetes		Current Tobacco Smoker
All optimal	<120 and <80	AND	<180	AND	No	AND	No
≥ 1 not optimal	120 to 139 or 80 to 89	OR	180 to 199	AND	No	AND	No
≥ 1 elevated	140 to 159 or 90 to 99	OR	200 to 239	AND	No	AND	No
1 major (exactly 1 of:)	≥ 160 or ≥ 100 or on treatment	OR	≥ 240 or on treatment	OR	Yes	OR	Yes
≥ 2 major (at least 2 of:)	≥ 160 or ≥ 100 or on treatment	OR	≥ 240 or on treatment	OR	Yes	OR	Yes

BP indicates blood pressure.

Table 2. Baseline Characteristics at Each Index Age

Index Age, y	45		55		65		75	
Sex	Men	Women	Men	Women	Men	Women	Men	Women
Mean age, y	42.4	42.4	51.9	51.9	61.0	61.1	71.1	71.1
Mean systolic BP, mm Hg	131.6	128.0	136.0	137.9	139.5	142.1	142.7	146.5
Mean diastolic BP, mm Hg	84.3	81.0	85.6	84.8	83.5	83.0	79.3	79.1
Mean cholesterol, mg/dL	229.0	217.6	234.6	247.5	229.5	254.9	220.8	247.4
Mean BMI	26.0	25.2	26.5	26.4	26.9	26.4	26.7	26.5
Diabetes mellitus (%)	1.0	1.0	2.0	2.0	6.0	4.0	12.0	8.0
Smoking (%)	77.0	45.0	64.0	37.0	43.0	29.0	27.0	19.0
Past CVD (%)	0.1	0.1	2.7	0.8	8.6	3.1	17.0	6.3
Aggregate risk factor burden (%)								
All optimal	0.7	3.1	0.9	1.1	0.6	0.3	1.5	0.5
≥1 not optimal	3.7	11.0	3.0	3.8	5.6	2.5	5.0	3.0
≥1 elevated	6.9	20.2	13.4	17.3	17.7	14.9	21.8	15.2
1 major	52.2	45.6	46.7	44.9	44.2	45.3	44.7	40.3
≥2 major	36.5	20.2	36.1	33.0	32.1	37.1	27.1	41.1

BMI indicates body mass index; BP, blood pressure; CVD, cardiovascular disease. Risk factor burden strata are as follows: “All Optimal”: <120 systolic blood pressure (SBP) and <80 diastolic blood pressure (DBP) and <180 total cholesterol (TCL) and no previous diabetes mellitus diagnosis and not a current smoker; “≥1 Not Optimal”: SBP between 120 and 139 or DBP between 80 and 89 or TCL between 180 and 199 and no previous diabetes mellitus diagnosis and not a current smoker; “≥1 Elevated”: SBP between 140 and 159 or DBP between 90 and 99 or TCL between 200 and 239 and no previous diabetes mellitus diagnosis and not a current smoker; “1 Major (Exactly 1 of)” requires exactly one of the following: SBP ≥160 or DBP ≥100 or on treatment for hypertension, TCL ≥240, or on treatment for high cholesterol or a diabetes mellitus diagnosis or a current smoker; “≥2 Major (at least 2 of)” requires at least 2 of the following: SBP ≥160 or DBP ≥100 or on treatment for hypertension or TCL ≥240 or on treatment for high cholesterol or a diabetes diagnosis or a current smoker.

SCD, adjusted for competing causes of death, was computed for men and women at each index age through age 84 years or to the oldest age with at least 100 weighted person-years of follow-up (to assure robust estimates), as in previous published analyses.^{6–12} A chi-squared test was used to test for statistical differences of lifetime risks to 85 years of age.

We also examined the association of individual risk factors with lifetime risk for SCD. Adjusted cumulative incidence rates for SCD were computed for levels of aggregate risk factor burden for each index age and sex. Significant secular trends in risk factor burden and in rates of overall CVD and CHD death over the last several decades have been notable, with lower overall CVD death rates and generally lower prevalence of elevated or adverse risk factors.³ Therefore, the

overall pattern of our results may be more important than the absolute precision of the lifetime risk estimates for more contemporary population samples.

In a sensitivity analysis of cumulative SCD risk for different index ages, we excluded participants who had been diagnosed with CVD between cohort inclusion and the index age.

Results

Participant characteristics at each index age are displayed in Table 2, stratified by sex. The proportion of individuals who had experienced a past CVD event ranged from 0.1% at index age 45 years to 17% among men at index age 75 years. As expected, mean systolic blood pressure (SBP) levels and the

Table 3. Cohort Size, Person-Years, Number of Deaths, and SCD Events for Selected Index Ages

Index Age, y	45		55		65		75	
Sex	Men	Women	Men	Women	Men	Women	Men	Women
N	1575	1929	2128	2623	1903	2421	1339	1894
Person-years of follow-up	48 096	66 624	48 986	70 068	29 065	44 635	10 929	20 178
Total deaths, N	1370	1481	1930	2161	1678	1333	1056	1399
SCD events, N (%)	178 (11.3)	57 (3.0)	249 (11.7)	104 (4.0)	202 (10.6)	98 (4.1)	93 (7.0)	59 (3.1)

SCD indicates sudden cardiac death.

Table 4. Total Lifetime Risk Estimates (95% CIs) for SCD (Through Age 85 Years)

Index Age, y	Men	Women
45	10.9% (9.4–12.5)	2.8% (2.1–3.5)
55	11.2% (9.9–12.6)	3.4% (2.7–4.1)
65	10.1% (8.7–11.5)	3.4% (2.7–4.2)
75	6.7% (5.3–8.1)	2.4% (1.7–3.1)

SCD indicates sudden cardiac death.

prevalence of diabetes mellitus were higher, and the prevalence of current smoking was lower, at older index ages. The distribution of individuals by aggregate risk factor burden is also presented in Table 2. At every index age, the majority (65–89%) of men and women had 1 or more major risk factors. In contrast, 0.3% to 3.1% of participants were in the all optimal risk factor stratum.

The number of individuals, person-years of follow-up, total deaths, and total SCDs are shown in Table 3, stratified by sex and index age. For example, there were 1575 men at index age 45 years who were followed for 48 096 person-years.

During this period, 1370 deaths occurred, of which 178 were attributed to SCD.

Overall lifetime risk estimates for SCD for the selected index ages are displayed in Table 4. Men had significantly higher lifetime risk estimates than women across all index ages. For example, men at index age 45 have a remaining lifetime risk of SCD of 10.9% (95% CI, 9.4–12.5), which is statistically different ($\chi^2=82.64$; $P<0.001$) from women at the same age, who have a 2.8% (95% CI, 2.1–3.5) remaining lifetime risk.

Adjusted cumulative risk curves for SCD by sex and aggregate risk factor strata at index age 45 years are displayed in Figure 1. Data for index ages 55, 65, and 75 years are displayed in Figures 2 through 4, respectively. Significant differences in lifetime risk ($P<0.05$) between those with all optimal risk factor burden compared to those with at least 2 major risk factors are noted in the figure captions. Overall, participants with 1 or at least 2 major risk factor strata had higher lifetime risk estimates for SCD compared to those with all optimal risk factor levels at all selected index ages; however, those differences were not significant for men or women at index ages 65 and 75. For instance, women at index age 55 had an adjusted cumulative lifetime risk of SCD

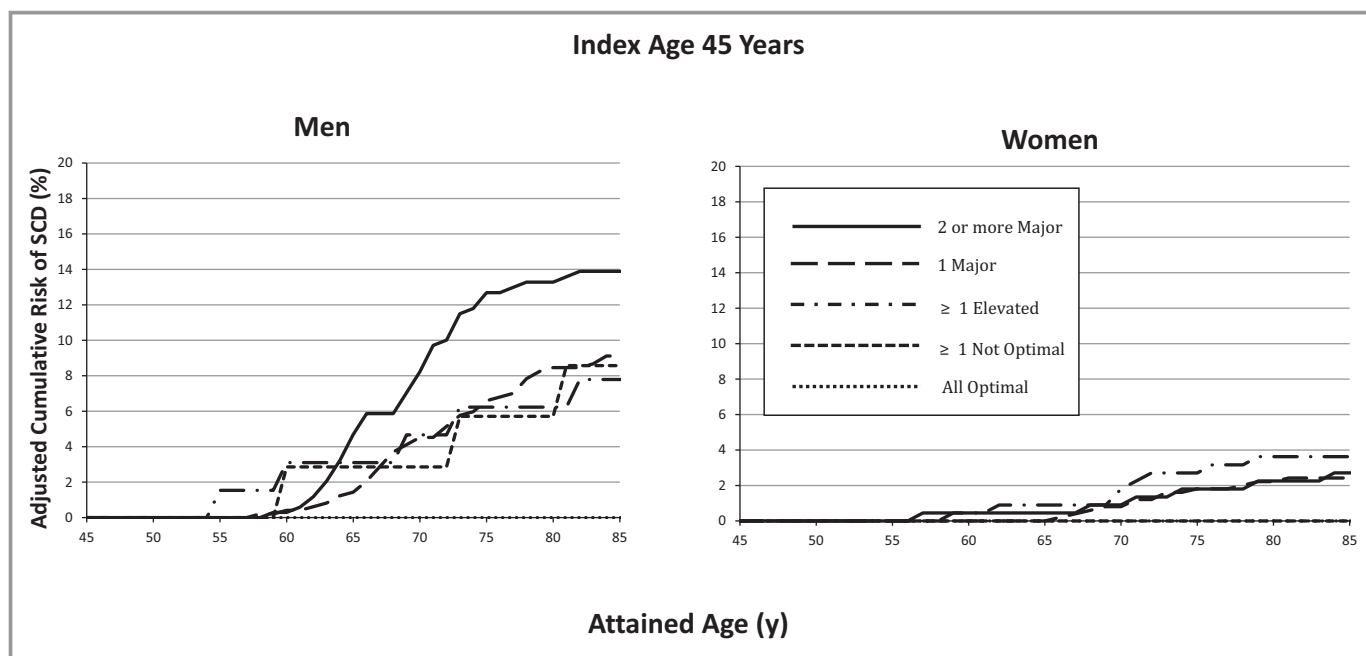


Figure 1. Lifetime risk for SCD at index age 45 years, stratified by aggregate risk factor burden and sex. Risk factor burden strata are as follows: “All Optimal”: <120 systolic blood pressure (SBP) and <80 diastolic blood pressure (DBP) and <180 total cholesterol (TCL) and no previous diabetes mellitus diagnosis and not a current smoker; “≥1 Not Optimal”: SBP between 120 and 139 or DBP between 80 and 89 or TCL between 180 and 199 and no previous diabetes mellitus diagnosis and not a current smoker; “≥1 Elevated”: SBP between 140 and 159 or DBP between 90 and 99 or TCL between 200 and 239 and no previous diabetes mellitus diagnosis and not a current smoker; “1 Major (Exactly 1 of)” requires exactly one of the following: SBP ≥160 or DBP ≥100 or on treatment for hypertension, TCL ≥240, or on treatment for high cholesterol or a diabetes mellitus diagnosis or a current smoker; “≥2 Major (at least 2 of)” requires at least 2 of the following: SBP ≥160 or DBP ≥100 or on treatment for hypertension or TCL ≥240 or on treatment for high cholesterol or a diabetes mellitus diagnosis or a current smoker. Lifetime risk of men and women with ≥2 major risk factors at index age 45 statistically differs from those with all optimal risk factor burden. SCD indicates sudden cardiac death.

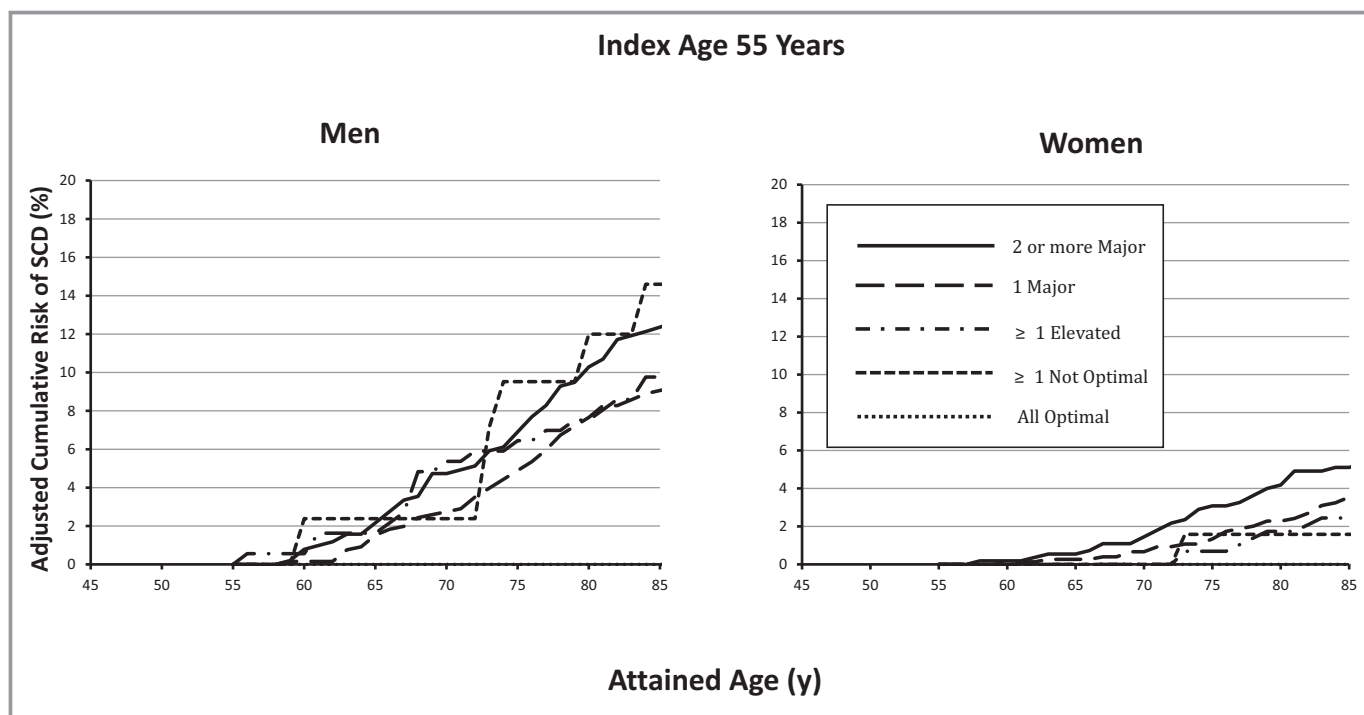


Figure 2. Lifetime risk for SCD at index age 55 years, stratified by aggregate risk factor burden and sex. Lifetime risk of men and women with ≥ 2 major risk factors at index age 55 statistically differs from those with all optimal risk factor burden. SCD indicates sudden cardiac death.

to age 85 years of 0% for those in the all optimal risk burden category, 1.6% for those with ≥ 1 not optimal risk factor, 2.4% for those with at least 1 elevated risk factor, 3.2% for those with 1 major risk factor, and 5.1% for those with at least 2

major risk factors. For women at index age 55, lifetime risk to age 85 was significantly different ($P < 0.05$) for women with all optimal risk burden when compared to those with 1 major risk factor or at least 2 major risk factors. Lifetime risk of women

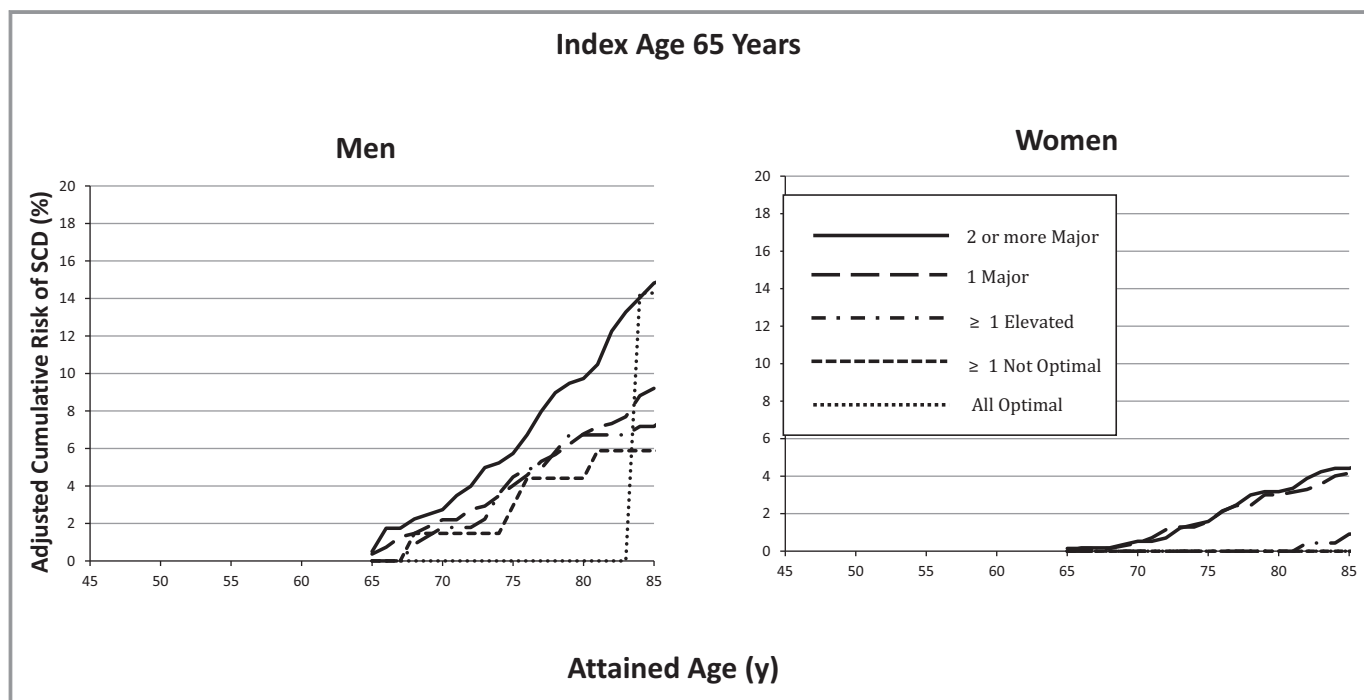


Figure 3. Lifetime risk for SCD at index age 65 years, stratified by aggregate risk factor burden and sex. Lifetime risk of men and women with ≥ 2 major risk factors at index age 65 does not statistically differ from those with all optimal risk factor burden. SCD indicates sudden cardiac death.

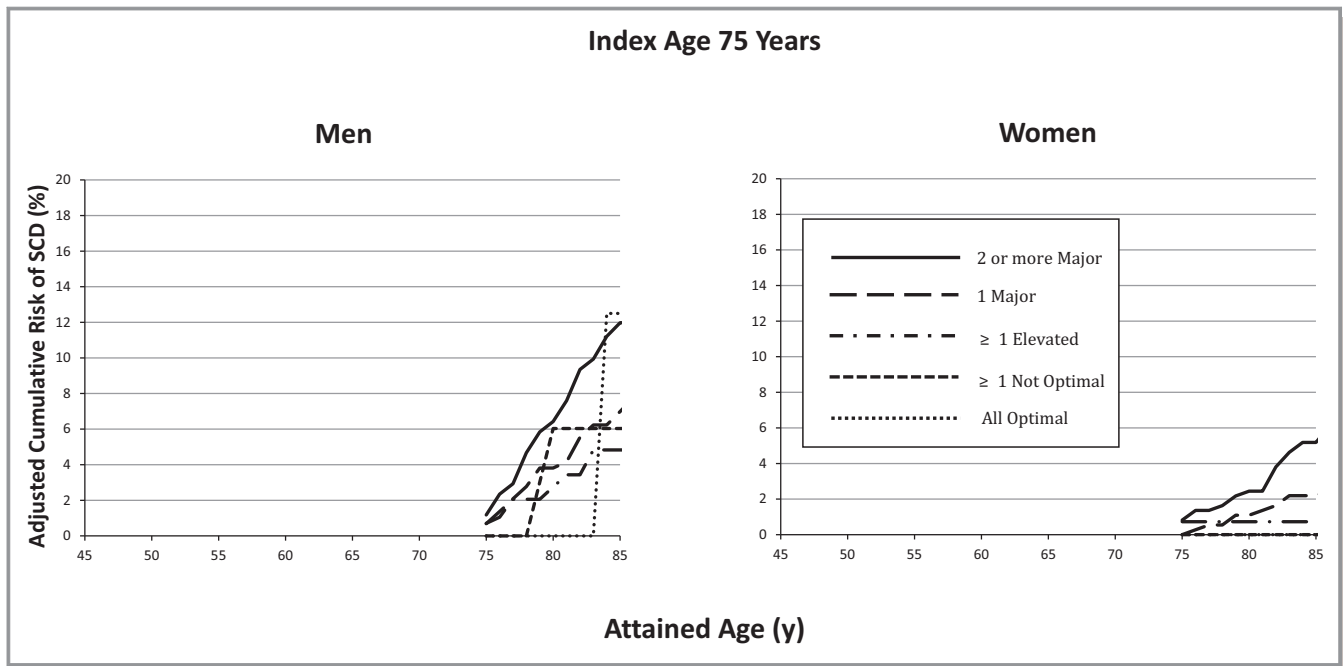


Figure 4. Lifetime risk for SCD at index age 75 years, stratified by aggregate risk factor burden and sex. Lifetime risk of men and women with ≥ 2 major risk factors at index age 75 does not statistically differ from those with all optimal risk factor burden. SCD indicates sudden cardiac death.

at index age 55 in ≥ 1 Not Optimal (1.6%) or ≥ 1 Elevated (2.4%) groups was significantly different ($P < 0.05$) when compared to those with at least 2 major risk factors (5.1%).

At every index age, men with 2 or more major risk factors had a lifetime risk for SCD that exceeded 12%, or ≈ 1 in 8. Furthermore, the majority of these sudden deaths occurred

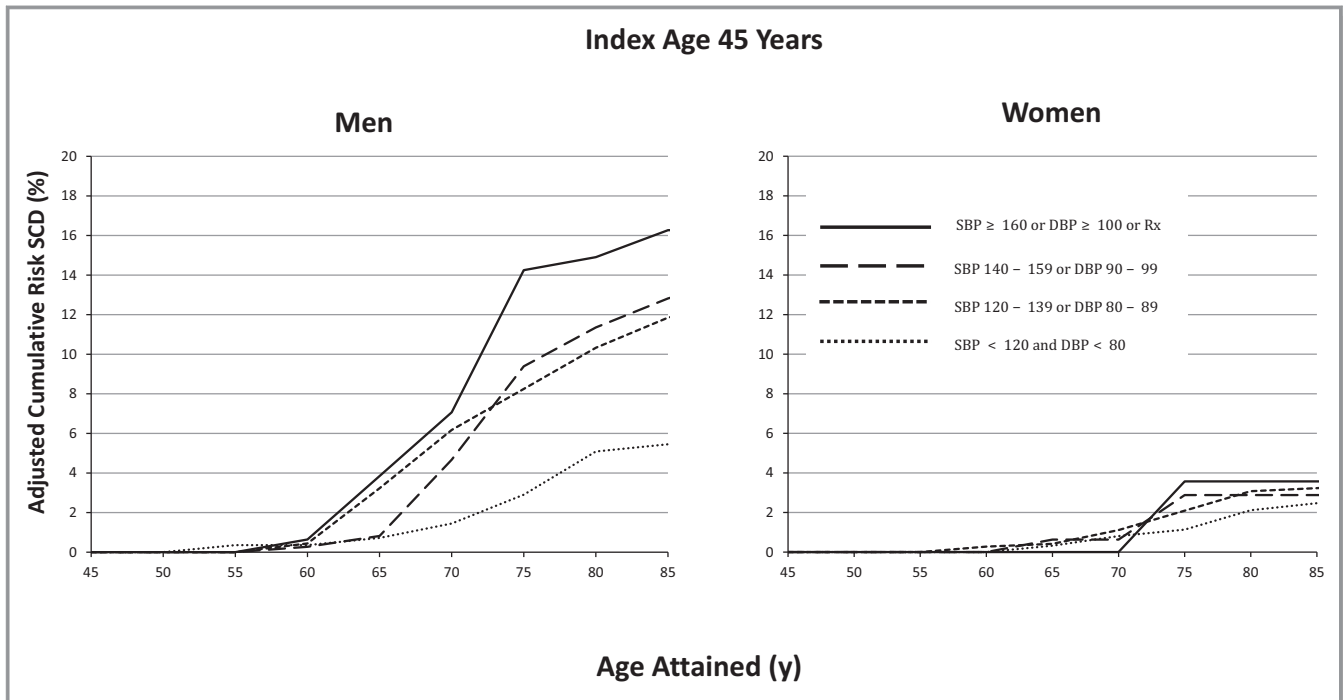


Figure 5. Lifetime risk for SCD at index age 45 years, stratified by blood pressure and sex. Lifetime risk of men with SBP < 120 and DBP < 80 at index age 45 significantly differs from those with SBP > 160 or DBP ≥ 100 or on hypertension treatment. Lifetime risk for women with SBP < 120 and DBP < 80 does not significantly differ from those with SBP > 160 or DBP ≥ 100 or on hypertension treatment. DBP indicates diastolic blood pressure; Rx, medical prescription; SBP, systolic blood pressure; SCD, sudden cardiac death.

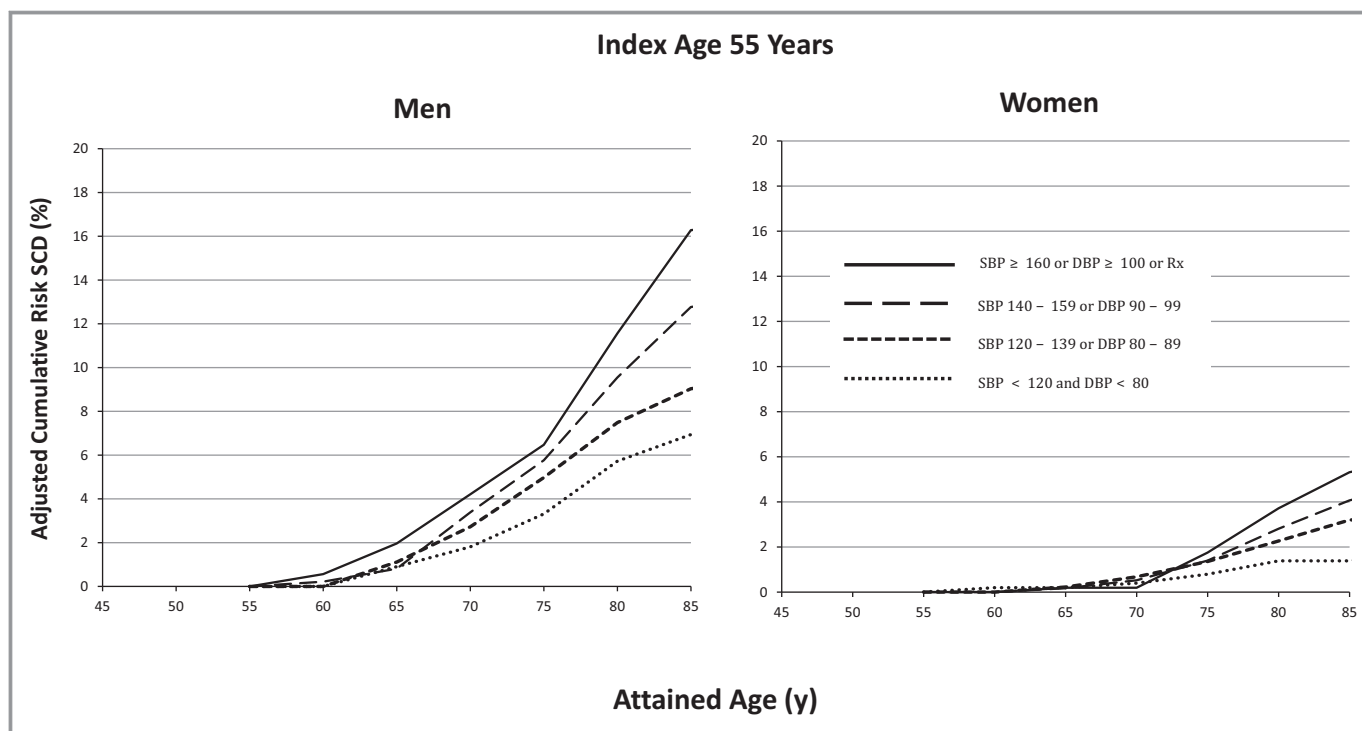


Figure 6. Lifetime risk for SCD at index age 55 years, stratified by blood pressure and sex. Lifetime risk of men and women with SBP <120 and DBP <80 at index age 55 significantly differs from those with SBP >160 or DBP ≥100 or on hypertension treatment. DBP indicates diastolic blood pressure; Rx, medical prescription; SBP, systolic blood pressure; SCD, sudden cardiac death.

before age 70 years. Men with at least 1 elevated risk factor had an adjusted lifetime risk score of more than 7%. Women have significantly lower cumulative lifetime risk for SCD than men with an adjusted lifetime risk of no more than 6% for any risk burden stratum.

We also examined lifetime risk for SCD by individual risk factor levels at the selected index ages. Blood pressure levels stratified lifetime risk for SCD better than any other single risk factor. Adjusted cumulative risks for SCD by blood pressure strata for index ages 45, 55, 65, and 75 years are shown in Figures 5 through 8, respectively. Significant differences in lifetime risk are between those in the lowest blood pressure category and the highest blood pressure category at baseline and are noted in the figure captions. For men at all index ages and women of all but index age 45, those in the highest 2 blood pressure categories also had the highest lifetime risk for SCD. For example, men at index age 45 with lowest baseline blood pressure had significantly lower lifetime risk ($P<0.001$) compared to those in any of the higher baseline blood pressure categories. Men at index age 45 in the lowest blood pressure category (SBP <120 mm Hg and diastolic blood pressure [DBP] <80 mm Hg) have an adjusted cumulative lifetime risk (through 85 years) for SCD of 5.5%, those with SBP between 120 and 139 mm Hg or DBP 80 to 89 mm Hg have a 11.9% lifetime risk, and those with SBP between 140 and 159 mm Hg or DBP 90 to 99 mm Hg have

a 12.8% lifetime risk, and those in the highest category (SBP ≥160 mm Hg, DBP ≥100 mm Hg, or on antihypertensive medication) have a 16.3% lifetime risk of SCD. Women had a significantly lower cumulative lifetime risk than men at all index ages, regardless of SBP/DBP, but blood pressure levels stratified their lifetime risk for SCD as well.

We performed a sensitivity analysis excluding those with manifest clinical CVD at each index age (data not shown). Differences from the primary analyses were negligible for each index age and sex, indicating that including those with past CVD history did not significantly alter our overall results.

Discussion

We describe the first estimates of lifetime risks for SCD. Total remaining lifetime risk estimates for men were at least twice that of women for all index ages (45, 55, 65, and 75 years). Men had a similar lifetime risk at index ages 45, 55, and 65, with estimates ranging between 10.1% and 11.2%. Women also had a similar remaining lifetime risk of SCD for all index ages, between 2.4% and 3.4%. The majority of SCD events occurred before age 70 years, indicating a substantial burden of sudden and premature mortality that is potentially preventable.

Overall, those in the higher aggregate risk burden strata (at least 1 elevated, 1 major, or at least 2 major) had higher

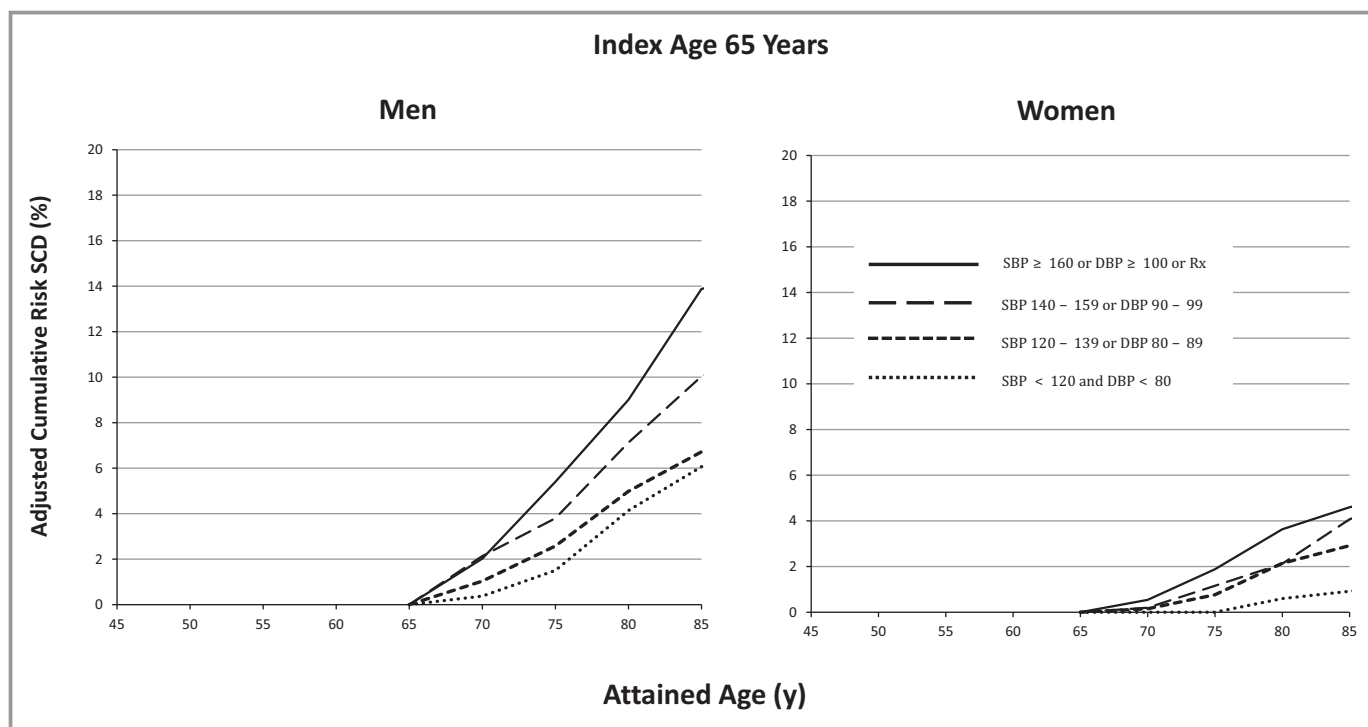


Figure 7. Lifetime risk for SCD at index age 65 years, stratified by blood pressure and sex. Lifetime risk of men and women with SBP <120 and DBP <80 at index age 65 significantly differs from those with SBP >160 or DBP ≥100 or on hypertension treatment. DBP indicates diastolic blood pressure; Rx, medical prescription; SBP, systolic blood pressure; SCD, sudden cardiac death.

lifetime risks than those in the lower risk burden strata. However, men with index age 55 in the at least 1 not optimal risk burden stratum had a higher cumulative lifetime risk than other strata past 70 years of age. This could indicate that a significant risk factor related to SCD was not included in our risk burden categories. It could also indicate that competing risk of death attributed to causes other than SCD is higher for those with greater aggregate burden of risk factors.

Stratifying individuals by blood pressure level alone resulted in notable separation of lifetime risk curves, with those in the highest blood pressure stratum always having the highest total lifetime risk and those in the lowest blood pressure stratum always having the lowest cumulative lifetime risk, regardless of sex or index age. Examining blood pressure level alone thus may be an important discriminator of those at highest risk for SCD in their lifetime, which could aid clinicians in targeting prevention efforts. Likewise, risks for SCD in men with 2 or more major risk factors were notably elevated.

Implications

SCD has a high prevalence, both in the United States and globally, with incidence in the United States alone estimated to be between 180 000 and 450 000 depending on case ascertainment and definition of SCD.¹ Stecker et al. recently estimated that, in the United States, the years of potential life

lost to SCD were 2.0 million for men and 1.3 million for women, which is greater than for any individual cancer and most other leading causes of death. Thus, whereas we observed that women have a significantly lower incidence, SCD still represents a major cause of life-years lost for both men and women.¹⁹

Currently, effective methods for early prediction of SCD do not exist. Our results suggest that using the easily ascertained risk factors of age, sex, SBP/DBP and total cholesterol levels, current smoking status, and diabetes mellitus diagnosis to categorize people into risk burden groups may be useful in stratifying lifetime risk for SCD. Furthermore, using only blood pressure levels was effective in categorizing FHS participants for most age/sex strata into distinct cumulative risk trajectories.

Given that many SCD events occur in individuals without past symptoms and occur prematurely, it is imperative for clinicians to consider factors that may increase risk for SCD. Our data suggest that a continued clinical and public health focus on the prevention of the development of risk factors (ie, primordial prevention) before middle age may be the best strategy to reduce the lifetime risk and overall burden of SCD. Once risk factors develop, lifetime risks for SCD are elevated, and more intensive efforts, including medications that have been shown to reduce CHD death, such as statins,^{20,21} may be needed in individuals at significant risk. Regarding the

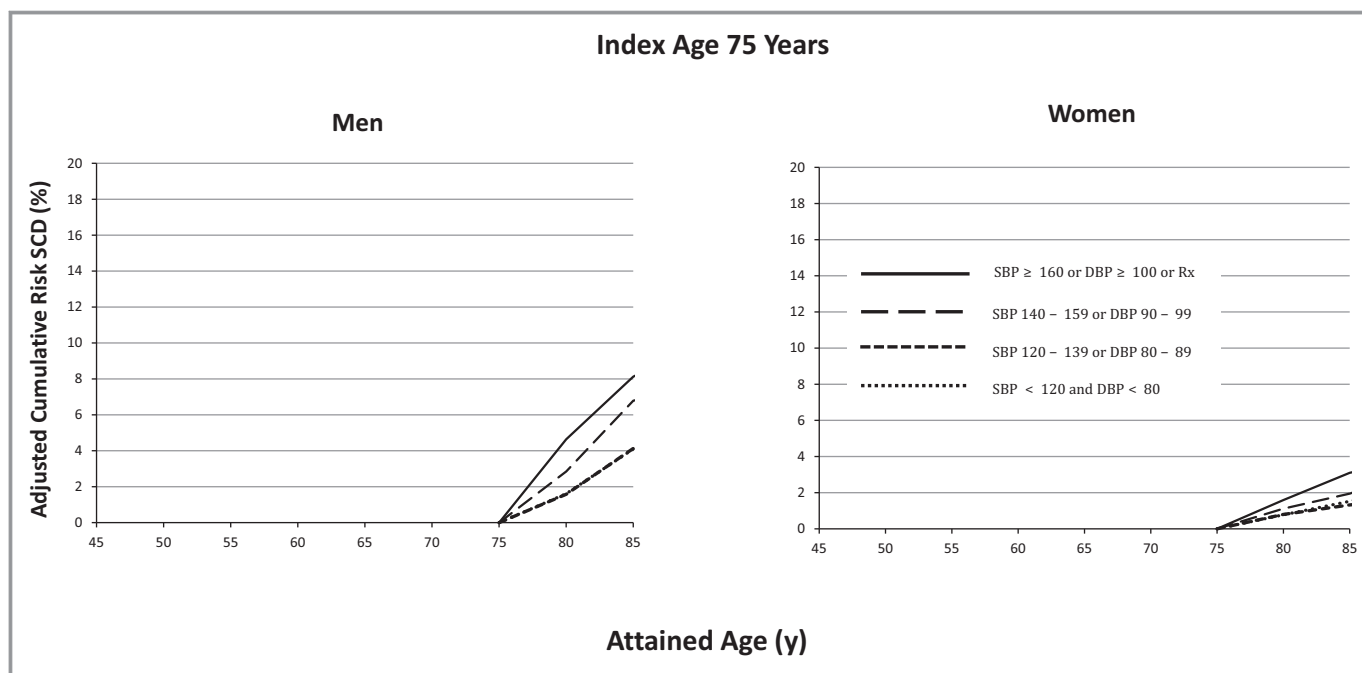


Figure 8. Lifetime risk for SCD at index age 75 years, stratified by blood pressure and sex. Lifetime risk of men and women with SBP <120 or DBP <80 at baseline differs from those with SBP \geq 160 or DBP \geq 100 or on hypertension treatment at baseline. DBP indicates diastolic blood pressure; Rx, medical prescription; SBP, systolic blood pressure; SCD, sudden cardiac death.

importance of blood pressure as an indicator of lifetime risk for SCD, our data also suggest the hypothesis that blood pressure reduction in patients with hypertension might reduce long-term SCD risk. This hypothesis is consistent with findings from clinical trials, in which blood pressure reduction was associated with substantial reduction in SCD risk, particularly among individuals with hypertension and manifest electrocardiographic left ventricular hypertrophy.²²

Strengths and Limitations

Our study's strengths include the relatively large sample size and long follow-up time, and the careful collection of evidence for adjudication of SCD events. Nonetheless, diagnosis of SCD as the underlying cause of death remains difficult. Our study also has several limitations. The FHS cohort is exclusively Caucasian, so our results may not be generalizable to other race/ethnic groups in whom SCD may be more or less common as a cause of death. Likewise, the lifetime risk of SCD in other race/ethnic group is likely to be a function of the burden of established risk factors and the burden of competing causes of death in those groups. Further study in other samples is encouraged. Because of the low prevalence of the all optimal aggregate risk factor burden stratum, this group had limited follow-up time in some instances, and had large confidence intervals around the estimates, resulting in unreliable conclusions for the all

optimal risk burden. When we stratified by index age, sex, and risk factor stratum, some of the resulting sample sizes also became small. As previously discussed, the overall patterns found in our results between groups may be more important than the exact estimates provided, because of changes in CVD death rates and risk factor prevalence over time. Our prior data examining secular trends in lifetime risks suggest that these data are still relevant to understanding the natural history for individuals in risk factor strata.⁶ Our analysis provides lifetime risk estimates by risk burden, age, and sex strata. True individual lifetime risk of SCD may vary from the estimates that our assessment provides, which is a limitation for all population-based models. However, we believe that these estimates may be useful for communicating risks of SCD with individuals who fit into a particular risk stratum, which may encourage adherence to recommended therapeutic lifestyle changes.

These first estimates of remaining lifetime risk for SCD in men and women in a well-characterized, longitudinally followed cohort provide important insights into potential prevention strategies for decreasing the ongoing substantial burden of SCD in the population.

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Disclosures

None.

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