The role of conventional risk factors in explaining social inequalities in coronary heart disease: the relative and absolute approaches to risk.

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Abstract

Background: Various methodologic approaches have been used to estimate the role of risk factors in explaining the social gradient in coronary heart disease (CHD).

Objective: Our objective was to examine whether there is a discrepancy in results obtained using the relative and absolute approaches.

Methods: Data are from the Whitehall II prospective cohort study on 5,363 men who were 40-62 years old at the start of the 11-year follow-up period.

Results: One or more of the four conventional risk factors examined (smoking, hypertension, high cholesterol, and diabetes) were present for 77% of individuals in the low compared with 68% in the high socioeconomic group. The relative risk for incident CHD in the low socioeconomic group was 1.66 (95% confidence interval = 1.20 to 2.29) compared with the high group. Standardizing the distribution of risk factors in the low- and high-socioeconomic group to the overall study sample reduced relative risk by 16% and absolute risk by 14%. We also computed the population attributable risk (PAR) to indicate the reduction in CHD if the risk factor was completely removed from the population. The PAR associated with having at least one risk factor was 41% (95% confidence interval = 33% to 57%) in the high and 58% (13% to 91%) in the low socioeconomic group.

Conclusions: In situations where the goal is to remove social differences in the distribution of risk factors, conventional risk factors explain a similar proportion of the social gradient in CHD whether using the relative or absolute approaches to change in risk. This is not comparable to population attributable risk calculations, in which the goal is to completely remove the risk factors from the population. Failure to recognize that these methods address different questions seems to be the reason for discrepancies in previous results.

Coronary heart disease (CHD) is a leading cause of morbidity and mortality[1-3] and in many populations shows a marked inverse social gradient.[4,5] There are two epidemiologic approaches to research in this domain. The first, common in CHD epidemiology, is to examine the causes of CHD at the population level by identifying specific factors that would reduce the population burden of disease.[2,3] The second, more common in social epidemiology, is to study the role of risk factors in explaining social inequalities in CHD.[6,7] Often, social epidemiologists examine the extent to which risk factors identified by CHD epidemiologists also explain social inequalities in CHD. Conventional risk factors (such as cholesterol, blood pressure, smoking and diabetes) do not explain away the social gradient in CHD, and so there have been attempts in social epidemiology to identify new risk factors that would add to the explanation of the social gradient in CHD.[3]

In a recent paper, Lynch and colleagues[8] suggest that results obtained from CHD epidemiology and social epidemiology represent an "apparent paradox" in terms of the discrepancies in the importance of "conventional risk factors" in explaining CHD. In their analysis, comparing the total cohort with a sub-cohort free of all risk factors, these risk factors explained the majority of absolute social inequality in CHD. However, the risk factors made only a modest contribution to explaining relative social inequality.

The objective of our paper is to take a closer look at this apparent paradox by examining the importance of "conventional risk factors" for CHD using both relative and absolute approaches to the comparison of risks. We intend to show that the "apparent paradox" in the results reported by Lynch and colleagues stems from the use of the relative and absolute approaches to answer different questions. We use prospective data on CHD from the Whitehall II study. In an attempt to replicate the study reported by Lynch et al.,[8] we use similar "conventional" risk factors, applied to the same period of follow-up, and we restrict our analyses to men. Finally, in order to extend the analysis presented by Lynch and colleagues and to illustrate the connections between CHD epidemiology and social epidemiology, we use population attributable risk (PAR) calculations within the social epidemiologic framework.

Methods

The Whitehall II study was established in 1985 as a longitudinal study to examine the socioeconomic gradient in health and disease among 10,308 civil servants (6,895 men and 3,413 women).[9] All civil servants aged 35-55 years in 20 London-based departments were invited by letter to participate, and 73% agreed. Baseline examination (Phase 1) took place during 1985-1988, and involved a clinical examination and a self-administered questionnaire. Subsequent phases of data collection have alternated between postal questionnaire alone and postal questionnaire plus a clinical examination. Since baseline, seven phases of data collection have been completed.

CHD incidence was assessed between Phases 3 (1991-1993) and 7 (2002-2004), a mean follow-up of 11 years (SD=2.9). CHD diagnoses included fatal CHD (ICD 9 codes 410–414 or ICD 10 codes I20-25), non-fatal myocardial infarction (MI) and "definite" angina. Based on all available data (from questionnaires, study ECGs, hospital acute ECGs, cardiac enzymes, physician records), non-fatal MI was defined following MONICA criteria.[10] Our definition of angina included self-reported cases of angina[11] only if they were subsequently verified by clinical records or abnormalities on a resting ECG, exercise ECG, or coronary angiogram.

Socioeconomic position was assessed by British civil service grade of employment at Phase 3. This is a 3-level variable representing high (administrative grades), intermediate (professional or executive grades) and low (clerical or support grades) position. People in the three groups differ with respect to salary, social status and level of responsibility. Although mostly white collar, respondents covered a wide range of socioeconomic positions, with annual salaries in 1995 ranging from £4,995 to £150,000.

Conventional risk factors, assessed at Phase 3 (1991-1993), were smoking (current smoking compared with other categories), hypertension (> 140/90 mm Hg or hypertension medications), elevated serum cholesterol (≥ 6.2 mmol/l) and diabetes (fasting glucose ≥ 6.1 mmol/l or diabetes drug).

Statistical analysis

The role of risk factors in explaining CHD was assessed in three ways.

Analysis 1: Relative approach to understanding social inequalities in CHD. This is the social epidemiologic perspective to estimating the contribution of risk factors to social inequalities in CHD. It consists of assessing the association between socioeconomic position and CHD, here using Cox proportional hazard models in analysis adjusted for age. The risk factors are added to this model, first individually and then all together. This type of regression-based adjustment approximates standardization to the risk factor distribution found in the total study population.[12] The contribution of the risk factor in explaining social inequalities in CHD was calculated using the following formula:

$(RR_{\text{SEP, controlling for age and risk factor}} - RR_{\text{SEP, controlling for age}})/(RR_{\text{SEP, controlling for age}} - 1)\times 100$.

Analysis 2: Comparison of relative and absolute approaches to understanding social inequalities in CHD. This second set of analyses extends the relative approach using hazard ratios described above, to include the absolute approach. The absolute approach calculates the change in excess rate (ie, the absolute difference in the rates) when adjustments are made for risk factors. In order to simplify the results, we restricted these analyses to the low and high socioeconomic groups of men with either no risk factors (the low-risk group) or those exposed to at least one of the four risk factors (the high-risk group), as in the paper by Lynch and colleagues[8]. Cross-tabulation of observed data was used to calculate the rate ratio and the excess absolute rate in the low socioeconomic group compared with the high group. These analyses were adjusted for age by stratifying the tabulation into two age groups, and for period of follow up, by using person-years as the denominators rather than the number of subjects. Thus, this approach matches the estimates obtained in analysis 1 using Cox regression. The adjustment for risk factors was achieved by standardization. This entails setting the proportion of the person-years for those men in the high and low socioeconomic groups who had 1-4 risk factors to be the same as that in the total study sample, making this analysis comparable with that of analysis 1. The standardized distribution was then used to calculate the number of CHD events that would be expected in the high and low socioeconomic groups. We performed this calculation separately in each of the age strata, and then summed the expected number of CHD events. Because of the relatively few low socioeconomic men in the low risk group, we have stratified age into only two strata. The difference in the rate ratio and absolute rate between the observed and the standardized data is expressed as a percentage.

Analysis 3: Absolute approach to understanding the role of risk factors for CHD. The population attributable risk was calculated in order to estimate the reduction in CHD if the risk factor were to be completely removed from the population. The formula used was pd*(RR-1)/RR, where pd is the proportion of cases exposed to risk factor and RR is the associated relative risk, estimated here using Cox regression.[13,14] The PAR was estimated for each risk factor separately and then for having at least one of the four risk factors. Using the bootstrap method,[15] we calculated 95% confidence intervals (CIs) for the PARs. These analyses were undertaken in the overall sample and also separately in the socioeconomic groups.

Results

Of the 6,895 men at baseline in the study, data on all measures used in the analysis were available for 5,363 men. Compared with the 1,532 men who did not have complete data, men included in this study did not differ markedly on socioeconomic position (p=0.18) or age (p=0.25). The average age of men included in the analysis was 49.9 (SD=5.9) for the high socioeconomic group, 48.6 (SD=6.0) for the intermediate group and 49.7 years (SD=6.3) for the low group at the start of the follow-up period (Phase 3). The distribution of risk factors as a function of socioeconomic position is shown in Table 1. Socioeconomic position was associated with smoking, hypertension, and diabetes, but not with cholesterol.

Table 2 presents the results aimed at identifying the contribution of each risk factor in explaining social inequalities in CHD (analysis 1). Age-adjusted analysis using Cox regression shows that the relative risk for CHD in the low socioeconomic group was 1.66 (95% CI=1.20-2.29) compared with the high socioeconomic group. Adding smoking to this model reduced the association in the low group by 18%. Similarly, hypertension explained 14%, high cholesterol 3% and diabetes 6% of the association between socioeconomic and CHD. All the risk factors taken together explained 38% of the relative risk in CHD in the low socioeconomic group. We repeated this analysis on CHD events excluding “definite” angina. These results (not shown) show the four risk factors explain 40% of the relative risk in CHD in the low socioeconomic group.

Table 3 presents the results from the relative and absolute approaches to examining the contribution of risk factors to social inequalities in CHD by standardizing the proportion of men with 1-4 risk factors (high-risk group) to be the same in the low and high socioeconomic groups (analysis 2). In the observed data, the rate ratio for CHD in the low socioeconomic group compared with the high group was 1.67 and the excess rate was 5.2 per 1000 person years. Overall, 67% (19426/29121) person-years in the high group and 76% (2565/3387) in the low socioeconomic group were in the high-risk group (1-4 risk factors). In the total study sample this percentage was 65% in the younger and 74% older age strata. Standardization implies setting these as the age-specific distributions of person-years in the two socioeconomic groups, leading to 20112 and 2338 person-years in the high and low groups respectively. The age-specific standardized distributions are used to calculate the expected number of CHD events in the two socioeconomic groups. This results in a CHD rate of 7.9 per 1000 person-years in the high socioeconomic group and 12.4 per 1000 in the low group, leading to a reduction in relative risk of 16%. The excess rate in the low SEP group changes from 5.2 to 4.5 per 1000 person-years, a reduction of 14%.

Table 4 presents the impact of risk factors from a PAR perspective; here the calculations estimate the reduction in CHD if the risk factor were to be completely removed from the population (analysis 3). The relative risk estimates for the four risk factors show hypertension to be the risk factor most strongly associated with CHD in the total population (RR=1.84; 95% CI=1.51 to 2.25) and in the high socioeconomic group (1.80; 1.35 to 2.41) and intermediate group (2.16;1.61 to 2.89). However, in the low socioeconomic group smoking has the strongest association (1.71; 0.93 to 3.14). Nevertheless, given the high prevalence of high cholesterol, both overall and in the three socioeconomic groups, cholesterol has the highest PAR: 25% (95% CI=15% to 36%) overall and in the three socioeconomic groups: high, 23% (8% to 38%); intermediate, 28% (12% to 43%); and low, 21% (-19% to 56%). The formula for the calculation of PAR shows it to be influenced by both the relative risk estimate and the prevalence. Hence, when stratifying by socioeconomic status, smoking has a PAR of 16% (-3% to 36%) in the low group and 0.1% (-3.3% to 4%) in the high group. The PAR associated with having at least one risk factor (i.e., 1-4 risk factors) was 46% (33% to 57%) overall. However, this varies as a function of socioeconomic position, ranging from 58% (13% to 91%) in the low group to 41% (23% to 57%) in the high group.

Discussion

Our intention in this paper was to examine whether there is a discrepancy between the relative and absolute explanations for social inequalities in CHD, as suggested in a recent paper.[8] Based on adjustments (similar to our analysis 1), those authors first estimated the role of risk factors in explaining the relative social gradient in CHD at 24%. They compared this to the reduction in excess absolute risk in the lowest versus highest socioeconomic group in a sub-population that was free from any of the 4 risk factors, relative to the corresponding excess absolute risk in the whole population, a difference of 72%. Finally, they calculated the PAR associated with having 1-4 risk factors at 68%. The different numbers (24%, 72% and 68%) were used to argue that there is an "apparent paradox" in the results obtained from the absolute and relative approaches to understanding social inequalities in CHD. We suggest that there is not a real or an apparent paradox in results. In fact, those numbers are not comparable because they address different questions. Our analysis is based on a population of similar age, with the same risk factors, and with a roughly similar period of follow-up – yet the results do not reveal a paradox. Three points require further discussion.

Importance of risk factors to social inequalities in CHD

In the Kuopio ischaemic heart disease risk factor study of 2682 Finnish men, smoking, hypertension, cholesterol and diabetes explained 24% of the relative risk of CHD in the low socioeconomic group compared with the high group.[8] In our sample of 5363 men from the British Whitehall II study, these four risk factors explained 38% of the increased relative risk in the low group. These two results are not incompatible. In general terms, the greater the social gradient in the risk factors being considered, the greater will be their contribution to the explanation of social inequalities in CHD. This is demonstrated in our analysis; smoking has the steepest social gradient (Table 1) and it explains the largest proportion of the relative risk in the low socioeconomic group (Table 2). It is possible that in populations where the risk factors show an even larger social gradient, the percentage of the social inequalities in CHD explained by these risk factors will be even greater. In populations where risk factors do not show a social distribution, their contribution to explaining the social gradient in CHD will be modest.

Absolute and relative approaches to explaining social inequalities in CHD

Lynch et al.[8] suggest that conventional risk factors account for the vast majority of CHD cases but explain a smaller proportion of the social inequalities in CHD. However, their calculation of the relative contribution of the risk factors to social inequalities in CHD (24%) is based on the whole population. In contrast, the calculation of reduction in excess absolute risk of CHD (estimated as 72% between the least and the most educated groups) compares the excess absolute risk in the whole population with that in a sub-population with no risk factors. These nested groups may differ in several ways in addition to the risk factors under study. For example, if risk factors are manifest at younger age in the socially disadvantaged group, the difference in age between the no-risk group (i.e., those who have no manifest risk factors) and the total population within the low socioeconomic group may be greater than that within the high socioeconomic group. Thus, the calculated reduction in absolute social inequalities by Lynch et al. actually simulates a situation where risk factors are removed from all social groups and, in addition, age is reduced to a greater extent in the low compared with the high socioeconomic group. We examined excess and relative risk reduction in the same population, i.e. in low and high socioeconomic groups. The standardization we used to adjust for risk factors is a simple way of setting the risk profile to be the same in the low and high groups, chosen here to be that in the overall study sample. The resulting reduction in the relative risk was 16% and that in the absolute risk was 14%.

In the analysis shown in Table 3, the standardization implied setting the risk factors in the low and high socioeconomic groups to be the same as that in the total study sample. Another public health goal could be to reduce the risk factors in the low group to be the same as that in the high group. Thus, the standard population used in analysis 2 would be the high socioeconomic group rather than the total study population. In this special situation, it can be shown that the relative and absolute approaches produce identical results (see Appendix). In our data this reduction is 19% – close to the 16% and 14% shown in Table 3. Thus, the "apparent paradox" concerning the importance of risk factors apparently stems from the fact that one method is based on the whole population and the other is based on comparison with a low risk sub-population that has no or few risk factors. By using two different populations, the relative and absolute approaches address different questions.

Population attributable risk and social inequalities in CHD

The approach used in social epidemiology differs from the approach using PAR, as the latter estimates the importance of risk factors by removing them from the population rather than by taking away their social distribution. PAR refers to the "proportion of disease cases over a specified time that would be prevented following elimination of the exposures, assuming the exposures are causal." [14] Besides causality, PAR also requires the risk factor to be completely eliminated from the population.[14,16] In addition, the PAR approach does not usually address the issue of social inequalities in a disease, as the intention is to examine the population as a whole and not sub-sections of the population. On the other hand, the social epidemiologic approach rarely attempts to calculate the social gradient in a disease in the absence of the risk factors being considered. It estimates only the reduction in CHD under the hypothesis that the risk factors under consideration are distributed in a similar manner across social groups. These two approaches are likely to lead to different results. Furthermore, the PAR estimate depends on both the relative risk associated with the risk factor and the prevalence of the risk factor in a particular population. Lynch et al.[8] report a PAR of 68% associated with having 1-4 risk factors. In our data, the corresponding PAR is lower at 46%. The prevalence of at least one of the four risk factors in the study analyzed by Lynch and colleagues was 85% compared with 70% of the Whitehall II participants. Thus, the difference in PAR associated with having one of the four risk factors is different in the two populations.

The PAR approach could be applied to the research on social inequalities in CHD. In our data, the PAR associated with smoking was larger in the low socioeconomic group compared with the high group. This is due to a stronger association between smoking and CHD, as well as the higher prevalence of smoking, in the low socioeconomic group compared with the high group. The INTERHEART study used data from 52 countries to estimate the PAR of major risk factors for myocardial infarction.[3] Globally, the three leading risk factors were abnormal lipids (PAR=49%), smoking (PAR=36%) and psychosocial factors (depression, locus of control, perceived stress and life events, with a PAR of 33%). However, there were large variations across regions and sex, leading the authors to state that "...the overall approach to prevention of coronary heart disease could be similar worldwide, but with varying emphasis in different subgroups (eg, sex and geographic region) based on the prevalence of individual risk factors and economic and cultural factors."[3]

Our calculation of PAR in analysis stratified by socioeconomic position is an attempt to show that this approach can be applied in social epidemiology to highlight the differing importance of risk factors in different socioeconomic groups. Unfortunately, our analysis is based on small numbers, leading to wide confidence intervals for the PAR estimates.

Nevertheless, one could speculate that the benefits of eliminating high cholesterol in this population would be evident in all three socioeconomic groups, but that of smoking would be particularly evident in the lowest group.

Limitations and conclusions

A limitation of these analyses is that the risk factors were chosen simply to replicate analyses in a previous paper and are therefore not complete. The intention here was to clarify the differences between the various approaches for assessing the role of risk factors in CHD and not to identify risk factors for CHD. PAR estimates should be interpreted with caution in observational data.[17] The risk factors considered here are likely to be associated with other risk factors and health behaviors. Thus, the elimination of these risk factors, if achieved, is unlikely to lead to the full predicted diminution in CHD incidence.

We show that the relative and absolute approaches to the role of risk factors in explaining social inequalities in CHD reveal similar results when applied to the same population. The focus here is on removing the social distribution in the risk factors, rather than removing the risk factors completely, in order to estimate the extent to which they contribute to social inequalities in CHD. This approach is also meaningful for CHD epidemiology as it addresses a more realistic goal compared with the "ideal" world scenario of complete elimination of the risk factor. Thus, examination of risk factors from the perspectives of CHD epidemiology and social epidemiology need not result in contradictory findings. We used the relative and absolute approaches to estimate the potential reduction in social inequalities that could be achieved by two different types of interventions aimed at changing the distribution of risk factors. In the first instance, the distribution in both the high and low socioeconomic group is changed to match that of the overall study population (Table 3) and the results show similar changes in relative and absolute risk. In the second scenario

(Appendix), the risk factor distribution in the low socioeconomic group is changed to match that in the high group. In this special case, the change in relative and absolute risk is identical. Finally, our PAR analysis estimates what the expected benefits are for each socioeconomic group under the most favorable option where the risk factors are completely eliminated from the whole population. Instead of an apparent paradox, these various estimations can contribute to a more comprehensive understanding of the reduction of social inequalities in health.

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Table 1 Distribution of risk factors (Phase 3, 1991-93) as a function of socioeconomic position.

	High SEP	Intermediate SEP	Low SEP
Risk factors	(n=2601)	(n=2413)	(n=349)
	No. (%)	No. (%)	No. (%)
Smoking	206 (8)	361 (15)	104 (30)
Hypertension	441 (17)	433 (18)	83 (24)
High cholesterol	1508 (58)	1387 (58)	205 (59)
Diabetes	153 (6)	177 (7)	39 (11)
1-4 risk factors	1767 (68)	1711 (71)	269 (77)

Table 2 Relative risk approach to assessing the role of risk factors in explaining social inequalities in CHD.[a]

Adjustment in addition to age	Socioeconomic Position (SEP)			% change[b] High/Low SEP
	High	Intermediate RR(95% CI)	Low RR(95% CI)	
None	1.0 (ref)	1.09 (0.91-1.32)	1.66 (1.20-2.29)	(ref)
Smoking	1.0 (ref)	1.07 (0.88-1.29)	1.54 (1.11-2.14)	-18%
Hypertension	1.0 (ref)	1.08 (0.89-1.31)	1.57 (1.14-2.17)	-14%
High cholesterol	1.0 (ref)	1.09 (0.90-1.32)	1.64 (1.19-2.26)	-3%
Diabetes	1.0 (ref)	1.08 (0.90-1.31)	1.62 (1.17-2.23)	-6%
All 4 risk factors		1.05 (0.87-1.27)	1.41 (1.01-1.96)	-38%

[a] No. of CHD events: 227 in the high-SEP group, 203 in the intermediate-SEP group, and 44 in the low-SEP group.

[b] Contribution of risk factor to explaining difference in CHD between the high and low SEP groups.

Table 3 Adjusting for risk factors using standardization among men with at least one risk factor: Reduction in relative and absolute rates.

	High-risk group (1-4 risk factors)			**Low-risk group (0 risk factors)**			**Total sample (low + high risk)**			**RELATIVE APPROACH**		**ABSOLUTE APPROACH**	
		CHD			CHD			CHD					
	Person -years at risk	No. Events	(Rate[a])	Person -years at risk	No. Events	(Rate[a])	Person -years at risk	No. Events	(Rate[a])	Rate Ratio[b]	% change[c]	Excess Rate[b]	% change[c]
Observed data													
High socioeconomic position[d]	19426	187	9.6	9695	40	4.1	29121	227	7.8	1.0		0.0	
Low socioeconomic position	2565	40	15.6	822	4	4.9	3387	44	13.0	1.67		5.20	

Age-standardized													
High socioeconomic position[d]	20112	193.2[e]	9.6	9009	37.1 [e]	4.1	29121	230.3 [e]	7.9	1.0		0.0	
Low socioeconomic position	2338	36.8[e]	15.8	1049	5.1 [e]	4.9	3387	41.9 [e]	12.4	1.56	-16%	4.45	-14%

[a] Rates per 1000 person-years

[b] Rate ratios calculated directly from observed and standardized rates in total sample.

[c] Change in rate ratio and excess rate between standardized and observed data as a percentage of the observed rate ratio and excess rate.

[d] Reference category.

e Expected number of CHD events calculated from the distribution of person-years standardized (within age strata) to that of the total study sample.

Table 4: Relative risk and population attributable risk of CHD associated with risk factors, by socioeconomic position.

	RR (95% CI)[a]	Prevalence in the total sample %	Prevalence in cases %	Population Attributable Risk (95% CI[b])
Total sample				
1-4 risk factors	2.16 (1.68 to 2.77)	70%	85%	46% (33% to 57%)
Smoking	1.39 (1.07 to 1.79)	13%	15%	4% (0.5% to 8%)
Hypertension	1.84 (1.51 to 2.25)	18%	31%	14% (9% to 20%)
High cholesterol	1.54 (1.27 to 1.89)	58%	71%	25% (15% to 36%)
Diabetes	1.43 (1.07 to 1.92)	7%	11%	3% (0.2% to 6%)
High SEP (N=2601)				
1-4 risk factors	1.98 (1.40 to 2.79)	68%	82%	41% (23% to 57%)
Smoking	1.02 (0.61 to 1.69)	8%	7%	0.1% (-3% to 4%)
Hypertension	1.80 (1.35 to 2.41)	17%	29%	13% (6% to 20%)
High cholesterol	1.49 (1.12 to 1.99)	58%	70%	23% (8% to 38%)
Diabetes	1.69 (1.10 to 2.58)	6%	11%	4% (0.1% to 9%)
Intermediate SEP (N=2413)				
1-4 risk factors	2.30 (1.54 to 3.44)	71%	86%	49% (30% to 65%)
Smoking	1.53 (1.08 to 2.17)	15%	19%	7% (0.3% to 13%)
Hypertension	2.16 (1.61 to 2.89)	18%	34%	18% (10% to 27%)
High cholesterol	1.64 (1.21 to 2.23)	58%	71%	28% (12% to 43%)
Diabetes	1.38 (0.89 to 2.13)	7%	11%	3% (-2% to 8%)
Low SEP (N=349)				

1-4 risk factors	2.79 (0.99 to 7.82)	77%	91%	58% (13% to 91%)
Smoking	1.71 (0.93 to 3.14)	30%	39%	16% (-3% to 36%)
Hypertension	0.98 (0.49 to 1.96)	24%	25%	-0.5% (-18% to 17%)
High cholesterol	1.41 (0.73 to 2.73)	59%	71%	21% (-19% to 56%)
Diabetes	0.91 (0.36 to 2.32)	11%	11%	-1% (-11% to 12%)

[a]Risk ratios are adjusted for age and SEP in the total sample and for age in SEP groups.

[b] Confidence interval estimated using bootstrap methods.

Appendix: To show the equality of relative and absolute approaches

Assume that the high SEP group is the reference and suppose that:

λ_0 = Risk in the high SEP,

λ_1 = Risk in the low SEP,

λ_1^* = Standardized risk in the low SEP

Using the relative approach :

Proportional Change in Relative Risk (RR) =

$$\frac{(RR-1)-(RR^*-1)}{RR-1} = \frac{\lambda_1/\lambda_0 - \lambda_1^*/\lambda_0}{\lambda_1/\lambda_0 - 1} = \frac{\lambda_1 - \lambda_1^*}{\lambda_1 - \lambda_0}$$

Using the absolute approach :

Proportional Change in Excess Risk (ER) = $\frac{ER - ER^*}{ER} = \frac{(\lambda_1 - \lambda_0) - (\lambda_1^* - \lambda_0)}{\lambda_1 - \lambda_0} = \frac{\lambda_1 - \lambda_1^*}{\lambda_1 - \lambda_0}$