Impact of Social Position on the Effect of Cardiovascular Risk Factors on Self-Rated Health

Cyrille Delpierre, PhD, Valérie Lauwers-Cances, MD, Geetanjali D. Datta, ScD, MPH, Lisa Berkman, PhD, and Thierry Lang, MD, PhD

Objectives. We assessed the impact of education level on the association between self-rated health and cardiovascular risk factors (blood pressure, glycosylated hemoglobin level, and total cholesterol and triglyceride levels).

Methods. We used data from the National Health and Nutrition Examination Survey for the years 2001 through 2004 (4015 men and 4066 women). Multivariate analyses were performed with a logistic regression model.

Results. After adjustment for age and ethnicity, among women with high glycosylated hemoglobin levels, the most-educated women had poorer self-rated health compared with the least-educated women (odds ratio [OR] =4.61; 95% confidence interval [CI]=2.90, 7.34 vs OR=2.59; 95% CI=1.60, 4.20, respectively; interaction test, P=0.06). The same was true among women with high cholesterol levels (OR=2.23; 95% CI=1.40, 3.56 vs OR=1.13; 95% CI=0.85, 1.49, respectively; interaction test, P=0.06). Among men, the impact of education level on the association between self-rated health and any cardiovascular risk factors (measured or self-reported) was not significant.

Conclusions. The impact of cardiovascular risk factors on self-rated health was higher for highly educated women, which could lead to underestimation of health inequalities between socioeconomic groups when self-rated health is used as an indicator of objective health. (*Am J Public Health.* 2009;99:1278–1284. doi:10.2105/AJPH.2008.147934)

Self-rated health is a useful measure of health status because it is a consistent predictor of mortality, is easy for researchers to use, and refers to a broad, multidimensional definition of health.[1] As a result, it is commonly used to study social inequalities in health[2]; however, this use can be problematic. The way people rate their health depends on their expectations of what their health should be, which in turn may be associated with their socioeconomic status. In many instances, researchers have reported that people are more likely to compare themselves with people they are socially similar to.[3,4] Studies have reported that socially advantaged groups might have higher expectations about their quality of life and health[5]; they may therefore feel that a particular illness has a greater negative impact on their health than do less socially advantaged people, for whom expectations are lower.

This phenomenon could lead to an underestimation of the health inequalities that exist between socioeconomic groups when self-rated health is used as an indicator of health. In a study comparing socioeconomic inequalities in health across 22 European countries, Mackenbach et al. showed that although the relative index of inequality (defined as the ratio of the estimated mortality or morbidity prevalence among people with the lowest education level to that among people with the highest education level, where education level is a proxy for socioeconomic status) was greater than 1 for both mortality and self-assessed health, it was higher for mortality (almost 2.2 for men and 1.8 for women) than for self-reported health (only about 1.4 for both men and women).[6] When mortality rather than self-assessed health was used as the outcome, the magnitude of the variations in the index of inequality across countries was also higher.

Three recent reports have shown some evidence for a modifying effect of socioeconomic status on the relationship between self-rated health and mortality.[7–9] Studies on this topic are still uncommon,[10] however, and to our knowledge, little work has investigated how socioeconomic status might modify the association between objective health status and self-rated health. One of the main challenges in conducting this kind of study is the definition and measure of "objective" health status, which is frequently measured from self-reports—making health status not truly objective—and is potentially influenced by how questions are answered in the same way as self-rated health.[11]

We assessed the overall impact of level of education on the link between self-rated health and health status as evaluated by biological indicators (blood pressure, glycosylated hemoglobin level, and cholesterol and triglyceride levels) in a representative sample of the noninstitutionalized US population.

METHODS

We used data from the 2001 to 2002 and 2003 to 2004 National Health and Nutrition Examination Survey (NHANES). The overall design of NHANES is described in detail elsewhere.[12] In brief, NHANES is a cross-sectional, nationally representative survey of the civilian noninstitutionalized population of the United States. Data are collected through in-person home interviews, physical examinations, and laboratory tests for multiple biological factors. Of the 25 917 people selected for the study, 21 161 (81.6%) completed the in-person home interview and 20 120 (77.6%) subsequently completed a physical examination. We restricted our analyses to respondents who completed the home interview and the physical examination. We excluded participants younger than 20 years (n=10 351) and pregnant women (n=515). Because the association between cardiovascular risk factors and self-rated health is probably different after cardiovascular disease, we excluded those who reported a diagnosis of cardiovascular disease (n=1173). The final sample consisted of 8081 participants (4015 men and 4066 women).

Self-Rated Health and Education Level

Individuals were asked to rate their health as excellent, very good, good, fair, or poor. In our

analyses, individuals reporting excellent, very good, or good health were classified as having good self-rated health and those reporting fair or poor health as having poor self-rated health.

Level of education was defined by highest level of education attained, categorized as less than 12 years (less than high school), 12 years (high school), and more than 12 years (more than high school).

Cardiovascular Risk Factors

The following biological indicators of cardiovascular risk factors were assessed: blood pressure, glycosylated hemoglobin level, total cholesterol level, and triglyceride level.

Three or 4 blood pressure readings were obtained from each participant. We used the average of the last 2 systolic and diastolic readings for the present analysis. High blood pressure was defined as having a mean systolic blood pressure of 140 mm Hg or higher, a mean diastolic blood pressure of 90 mm Hg or higher, or current use of antihypertensive medication. Because glucose measurements were available only for those who had their physical examination in the morning, we used glycosylated hemoglobin level, which was available for the full sample. High glycosylated hemoglobin was defined as a level of 6.5% or higher or use of diabetes medication. High total cholesterol was defined as a level of 240 mg/dL or higher or a self-report of taking prescribed cholesterol-lowering medicine. High triglyceride was defined as a 12-hour fasting triglyceride level of 250 mg/dL or higher or a nonfasting level of 500 mg/dL or higher.

Studies have found that labeling individuals as "sick," even when they may not be, may adversely affect their self-rated health.[13,14] ("Labeling" refers to a participant's self-report of a physician diagnosis of a particular disease.) We therefore created dichotomous label variables to delineate those labeled as hypertensive, with diabetes, or with hypercholestolemia before the physical examination (self-report of a physician diagnosis of 1 of these diseases) and those not so labeled. Treated persons were considered as labeled. This type of variable was not created for triglyceride level because participants were not asked whether a physician had previously told them that they had elevated triglyceride levels.

Covariates

The sociodemographic variables used in the analyses were as follows: age, gender, ethnicity (non-Hispanic White, non-Hispanic Black, Mexican American, or other), marital status (married or living with partner, single, divorced or separated, widowed), and health insurance (no insurance, public insurance, private insurance).

Cigarette smoking status was coded as never, former, or current from self-reports. A current smoker was defined as someone who had smoked at least 100 cigarettes during his or her lifetime and still smoked. A former smoker was someone who had smoked at least 100 cigarettes during his or her lifetime but no longer smoked. During the medical examination, physicians asked participants about alcohol consumption. Abstainers were defined as individuals who reported either not drinking or drinking on fewer than 12 occasions during the previous year. Drinkers were defined as those who reported drinking on at least 12 occasions during the previous year. Participants were classified according to their average daily volume of alcohol consumption (0, <1, ≤ 2, or >2 drinks/day).

Level of physical activity was assessed from self-report. Participants were asked if they participated in moderate activities (causing only light sweating or a slight to moderate increase in breathing or heart rate), vigorous activities (causing heavy sweating or large increases in breathing or heart rate), or muscle-strengthening activities for at least 10 minutes in the previous 30 days. Individuals who reported at least 1 of these types of activities were classified as active; all others were classified as nonactive.

Body mass index (BMI), calculated as weight in kilograms divided by the square of height in meters, was obtained by physical examination. Overweight was defined as a BMI of 25.0 to 29.9 and obesity as a BMI of 30.0 or higher.

Analyses

All our analyses were run separately for men and women. The P values from the Wald χ^2 test were used to compare percentages across groups. We ran 3 sets of models. The first had self-rated health as the outcome and included terms for education, each cardiovascular risk factor separately, and the interaction between the two. The second one stratified the sample by education level, adjusting for age and ethnicity, and the third one adjusted for age, ethnicity, marital status, health insurance, BMI, smoking, drinking consumption, and physical activity.

We used the clinical sampling weights from the physical examinations to produce our weighted estimates and sampling errors. Sampling weights were used to adjust for nonresponse bias and the oversampling of non-Hispanic Blacks, Mexican Americans, low-income individuals, adolescents, and elderly individuals in NHANES. Statistical analyses were performed with SAS version 9.1 (SAS Institute Inc, Cary, North Carolina).

RESULTS

Social characteristics and health behaviors of the study population, broken down by gender, are shown in Table 1. Compared with women, men were more likely to be younger, to be married or living with a partner, to have a BMI above 25.0, to be smokers and drinkers, and to be physically active.

Approximately the same proportion of men and women reported poor health (13.6% vs 15.1%, respectively). Men were less likely than women to have high blood pressure (26.5% vs 30.0%; $P<.003$) but more likely to have a high glycosylated hemoglobin level (7.6% vs 6.3%; $P=.01$) and high triglyceride level (6.1% vs 3.0%; $P<.001$). Regarding labeled cardiovascular risk factors, men were less likely than women to report hypertension (22.9% vs 25.9%; $P=.04$). No other gender differences were observed for labeled diabetes or for labeled high cholesterol level (Table 2).

Cardiovascular Risk Factors, Self-Rated Health, and Level of Education

We observed a positive relationship between education level and self-rated health. For both men and women, higher level of education was associated with higher self-rated health. Although men with low levels of education were more likely to have high blood pressure than were more highly educated men, they were not more likely to report having high blood pressure. Men with low levels of education were also more likely to have high glycosylated hemoglobin levels and

TABLE 1—Sample Social Characteristics and Health Behaviors, by Gender: National Health and Nutrition Examination Survey, 2001–2004

	Men	Women
Sample size, no.	4015	4066
Age, y, mean (SE)	43.1 (0.3)	45.4 (0.4)
Education level,[a] y, % (SE)		
<12	17.8 (0.8)	17.2 (0.8)
12	26.9 (0.9)	25.8 (0.8)
>12	55.3 (1.1)	57.0 (1.1)
Ethnicity, % (SE)		
Non-Hispanic White	72.0 (2.1)	71.9 (2.3)
Non-Hispanic Black	10.6 (1.2)	11.7 (1.4)
Mexican American	8.7 (1.1)	6.7 (1.0)
Other	8.7 (1.2)	9.7 (1.3)
Marital status,[b] % (SE)		
Married or living with partner	67.7 (1.1)	61.3 (0.8)
Single	21.1 (1.2)	16.3 (1.0)
Divorced or separated	9.5 (0.7)	13.8 (0.7)
Widowed	1.7 (0.2)	8.6 (0.4)
Health insurance,[c] % (SE)		
None	21.4 (0.8)	16.1 (0.8)
Public	11.3 (0.6)	16.2 (0.7)
Private	67.3 (1.1)	67.7 (1.1)
BMI,[d] % (SE)		
<25 kg/m^2	30.6 (0.8)	39.6 (1.2)
25–29.9 kg/m^2	41.0 (0.9)	28.6 (1.1)
≥30 kg/m^2	28.4 (0.9)	31.8 (1.0)
Smoker,[e] % (SE)		
No	35.2 (1.3)	56.2 (1.3)
Former	34.2 (1.2)	23.1 (0.9)
Current	30.6 (0.9)	20.7 (1.0)
Drinking,[f] % (SE)		
None	22.5 (2.0)	33.5 (2.1)
<1 drink/d	54.7 (1.5)	59.3 (1.8)
1–2 drinks/d	16.7 (0.7)	6.5 (0.7)
>2 drinks/d	6.1 (0.6)	0.7 (0.2)
Physical activity,[g] % (SE)		
Inactive	27.8 (1.3)	32.5 (1.1)
Active	72.2 (1.3)	67.5 (1.1)

Note. BMI = body mass index.
[a]Data missing for 5 men and 6 women.
[b]Data missing for 3 men and 2 women.
[c]Data missing for 75 men and 75 women.
[d]Data missing for 138 men and 165 women.
[e]Data missing for 1 man and 2 women.
[f]Data missing for 303 men and 393 women.
[g]Data missing for 2 women.

to report having diabetes than were more highly educated men (Table 2). The proportion of men with high cholesterol or high triglyceride levels did not differ according to education level, but the most-educated men were more likely to report high cholesterol level.

Among women, those with low levels of education were more likely to have cardiovascular risk factors than were more highly educated women, except for high triglyceride levels (Table 2). They were also more likely to report hypertension and diabetes. There were no observed differences in self-reported high cholesterol level by level of education.

Tables 3 and 4 show the relation between poor self-rated health and cardiovascular risk factors as determined by laboratory tests and between poor self-rated health and self-report of diagnosed cardiovascular risk factors (i.e., labeled cardiovascular risk factors), stratified by education level, among men and women. The odds ratio (OR) for the association between poor self-rated health and labeled cardiovascular risk factors was generally higher than that for the association between poor self-rated health and biological measures of cardiovascular risk factors.

Among men, after adjustment for age and ethnicity, high blood pressure and high glycosylated hemoglobin levels were associated with poor self-rated health at every education level, whereas high cholesterol or triglyceride level was not associated with poor self-rated health. Regarding labeling effect, reporting hypertension, diabetes, or high cholesterol level was associated with poor self-rated health at every level of education. Among men, interactions between level of education and any cardiovascular risk factors (labeled or measured) were not significant.

Among women, high levels of glycosylated hemoglobin were associated with poor self-rated health at every education level, whereas high blood pressure and high cholesterol levels were associated with poor self-rated health only among the most-educated women. Regarding labeling effect, reporting hypertension or diabetes was associated with poor self-rated health at every level of education, whereas labeled high cholesterol level was associated with self-rated health only among the most-educated women. After adjustment for age and ethnicity, among women with high levels of glycosylated hemoglobin, the most educated had higher odds of poor self-rated health than did the least educated (OR=4.61; 95% confidence interval [CI]=2.90, 7.34 vs OR=2.59; 95% CI=1.60, 4.20; interaction test, P=.06); the same held true for women with high cholesterol levels (for the most-educated women,

TABLE 2—Sample Health and Education Level, by Gender: National Health and Nutrition Examination Survey, 2001–2004

	Men's Education Level				Women's Education Level			
	<12 y	12 y	>12 y	*P*	<12 y	12 y	>12 y	*P*
Sample size, no.	1199	989	1822		1113	1006	1941	
Self-rated health								
Poor, % (SE)	29.0 (1.9)	16.0 (1.7)	7.5 (0.7)	<.001	34.0 (1.6)	18.9 (1.3)	7.6 (0.7)	<.001
Missing data, no.	1						2	
Clinical blood pressure								
High, % (SE)	32.1 (2.0)	26.0 (1.9)	25.0 (1.3)	.003	39.8 (2.3)	35.5 (1.8)	24.6 (1.2)	<.001
Missing data, no.	67	34	56		61	49	96	
Self-reported blood pressure								
High, % (SE)	25.3 (1.8)	22.0 (1.5)	22.5 (1.3)	.27	32.2 (2.2)	31.1 (1.8)	21.8 (1.5)	<.001
Missing data, no.	52	19	9		9	8	5	
Clinical glycosylated hemoglobin level								
High, % (SE)	12.5 (1.3)	5.6 (0.9)	7.0 (0.7)	<.001	9.9 (1.1)	7.3 (0.6)	4.8 (0.7)	.003
Missing data, no.	70	46	63		55	46	76	
Diabetes								
Self-reported diabetes, % (SE)	8.0 (0.8)	4.5 (0.7)	5.9 (0.6)	.01	8.5 (0.9)	7.1 (0.7)	4.2 (0.6)	.001
Missing data, no.	1							
Clinical cholesterol level								
High, % (SE)	23.0 (1.6)	23.6 (1.5)	25.0 (1.2)	.55	25.7 (1.9)	27.1 (1.9)	20.4 (1.2)	<.001
Missing data, no.	84	47	62		82	64	95	
Self-reported cholesterol level								
High, % (SE)	8.6 (1.0)	12.1 (1.1)	12.3 (1.1)	.04	13.2 (2.2)	11.0 (1.2)	9.0 (0.7)	.13
Missing data, no.								
Clinical triglyceride level								
High, % (SE)	6.0 (1.2)	5.0 (1.1)	6.8 (0.6)	.53	3.2 (0.8)	3.8 (0.7)	2.5 (0.5)	.30
Missing data, no.	90	52	76		92	71	107	

OR=2.23; 95% CI=1.40, 3.56; for the least-educated women, OR=1.13; 95% CI=0.85, 1.49; interaction test, *P*=.06). Conversely, among women with high triglyceride levels, the least educated had higher odds of poor self-rated health than did the most educated (OR=1.89; 95% CI=0.93, 3.86 vs OR=0.75; 95% CI=0.23, 2.38; interaction test, *P*=.09). Regarding the potential labeling effect, among women who reported hypertension, the most educated had higher odds of poor self-rated health than did the least educated (OR=3.21; 95% CI=2.15, 4.80 vs OR=1.75 (95% CI=1.20, 2.57); the same held true for women reporting high cholesterol levels (for the most-educated women, OR=3.51; 95% CI=1.82, 6.80; for the least-educated women, OR=1.38; 95% CI=0.76, 2.48), although the test for interaction was not significant (interaction test for self-reported hypertension, *P*=.12; interaction test for self-reported high cholesterol level, *P*=.10).

All models were constructed with adjustment for marital status, health insurance, BMI, smoking, drinking, and physical activity simultaneously (Tables 3 and 4). Among women, adjustment for the full set of covariates attenuated the interaction existing between self-rated health, cardiovascular risk factors, and level of education.

DISCUSSION

To our knowledge, our study is one of the first to analyze how social conditions modify the relation between objective health status, as evaluated by cardiovascular risk factors, and self-rated health. Our results show that this relation is moderated by level of education and that the impact of health problems on self-rated health is worse among more highly educated women. Among men, this phenomenon was not significant.

As expected, in bivariate analysis of each cardiovascular risk factor (Table 2), there was an association between education and self-rated health; people with lower levels of education were more likely to report poor self-rated health than were more highly educated people. However, education level moderated the relation between self-rated health and cardiovascular risk factors and health conditions among women. In multivariate analysis, the association between high glycosylated hemoglobin or high cholesterol levels and poor self-rated health was stronger among those who were more highly educated. One hypothesis to explain this finding is that one's expectations about one's health increase with increasing level of education.[15,16] Thus, the impact of health

TABLE 3—Relation Between Clinically Determined and Self-Report of Diagnosed Cardiovascular Risk Factors and Poor Self-Rated Health Among Men, by Education Level: National Health and Nutrition Examination Survey, 2001–2004

	Men's Education Level		
	<12 y	12 y	>12 y
Clinical high blood pressure			
No, %	23.7	13.1	6.3
Yes, %	41.0	24.0	12.0
AOR[a] (95% CI)	1.91 (1.28, 2.84)	2.06 (1.17, 3.61)	1.70 (1.21, 2.40)
AOR[b] (95% CI)	1.65 (1.09, 2.51)	1.97 (1.13, 3.46)	1.41 (0.91, 2.16)
Self-reported high blood pressure			
No, %	22.9	13.6	5.4
Yes, %	47.3	24.6	15.4
AOR[a] (95% CI)	2.68 (1.72, 4.19)	2.00 (1.06, 3.78)	2.95 (2.02, 4.30)
AOR[b] (95% CI)	2.33 (1.44, 3.78)	1.83 (0.91, 3.66)	2.63 (1.66, 4.14)
Clinical high glycosylated hemoglobin level			
No, %	27.0	14.1	6.8
Yes, %	50.8	44.1	20.4
AOR[a] (95% CI)	2.30 (1.44, 3.69)	5.05 (2.63, 9.70)	2.89 (1.92, 4.36)
AOR[b] (95% CI)	1.97 (1.20, 3.22)	4.28 (2.07, 8.84)	2.08 (1.25, 3.48)
Self-reported diabetes			
No, %	27.3	14.7	6.7
Yes, %	57.1	44.7	22.3
AOR[a] (95% CI)	2.83 (1.39, 5.76)	4.73 (2.32, 9.64)	3.25 (1.87, 5.67)
AOR[b] (95% CI)	2.86 (1.36, 6.04)	3.50 (1.63, 7.52)	2.61 (1.48, 4.60)
Clinical high cholesterol level			
No, %	28.5	15.3	7.6
Yes, %	34.2	17.6	7.4
AOR[a] (95% CI)	1.15 (0.78, 1.71)	1.06 (0.60, 1.87)	0.85 (0.58, 1.25)
AOR[b] (95% CI)	1.13 (0.78, 1.63)	1.05 (0.63, 1.75)	0.82 (0.51, 1.33)
Self-reported high cholesterol level			
No, %	27.8	14.5	7.1
Yes, %	48.1	27.1	12.0
AOR[a] (95% CI)	1.76 (1.02, 3.04)	2.09 (1.00, 4.35)	1.54 (1.00, 2.36)
AOR[b] (95% CI)	1.68 (1.03, 2.74)	2.17 (1.06, 4.47)	1.54 (0.95, 2.49)
Clinical high triglyceride level			
No, %	29.6	15.6	7.4
Yes, %	35.5	21.0	10.2
AOR[a] (95% CI)	1.23 (0.64, 2.37)	1.42 (0.59, 3.45)	1.43 (0.63, 3.24)
AOR[b] (95% CI)	0.93 (0.44, 1.97)	1.38 (0.62, 3.03)	0.98 (0.41, 2.33)

Note. AOR = adjusted odds ratio; CI = confidence interval.
[a]Adjusted for age and ethnicity (reference group = no).
[b]Adjusted for age, ethnicity, marital status, health insurance, body mass index, smoking, drinking, and physical activity (reference group = no).

problems on self-rated health may be worse for those with higher health expectations. Another hypothesis, as proposed by Frijling et al., is that education is related to one's ability to estimate risk.[17] When they have a disease, more highly educated people are more likely to be aware of the consequences of a health problem, in terms of morbidity or mortality risks, and thus more likely to report poor self-rated health. Thus, by using self-rated health as an indicator for evaluating social inequalities in health, researchers could underestimate the magnitude of these disparities.

This phenomenon was not observed among men, for whom we observed no influence of education on the association between cardiovascular risk factors and self-rated health. Ross et al.[18] showed that women depend more on education to achieve well-being than do men, who are more likely to have such additional resources as adequate income[19] and authority at work that allow better access to care. Alternatively, a number of studies suggest that women are more likely than men to include both health-related and non–health-related factors when judging their health.[20] This gender-specific conception of health may be influenced by the level of education, more so for women than for men.

Both men and women who reported being told by a doctor that they had any of the cardiovascular risk factors we studied were more likely to report poor self-rated health than were those whose physical examinations revealed high blood pressure, high glycosylated hemoglobin, cholesterol, or triglyceride levels. This labeling effect has been previously identified as an independent risk factor of poor self-rated health. Barger and Muldoon[14] showed that the association between labeled high blood pressure and poor self-rated health was stronger than the association between examination-determined high blood pressure and self-rated health. Thus, it seems that once a specific disease is diagnosed, being identified as sick negatively influences self-rated health and could actually have a worse impact on one's health than the disease itself. This impact could be higher in highly educated people, as observed in our study, where the interaction between labeled hypertension and high level of education was only significant among men and women with high blood pressure, the impact of labeled high blood pressure on self-rated health being higher for the most-educated people (data not shown).

For both genders, the proportion of those who self-reported high blood pressure, diabetes, or high cholesterol level was lower than the proportion of people with clinically determined high blood pressure, high glycosylated hemoglobin, or high cholesterol levels. However, reporting cardiovascular risk factors was associated with level of education only among men; the least-educated men were more likely to

TABLE 4—Relation Between Clinically Determined and Self-Report of Diagnosed Cardiovascular Risk Factors and Poor Self-Rated Health Among Women, by Education Level: National Health and Nutrition Examination Survey, 2001–2004

	Women's Education Level		
	<12 y	12 y	>12 y
Clinical high blood pressure			
No, %	29.6	14.6	5.5
Yes, %	43.1	22.9	12.2
AOR[a] (95% CI)	1.58 (0.94, 2.64)	1.48 (0.97, 2.28)	2.58 (1.54, 4.31)
AOR[b] (95% CI)	1.46 (0.93, 2.28)	1.54 (0.98, 2.41)	2.50 (1.47, 4.24)
Self-reported high blood pressure			
No, %	29.7	14.7	5.2
Yes, %	44.9	24.6	14.7
AOR[a] (95% CI)	1.75 (1.20, 2.57)	1.77 (1.06, 2.93)	3.21 (2.15, 4.80)
AOR[b] (95% CI)	1.67 (1.20, 2.33)	1.81 (1.08, 3.02)	2.91 (1.85, 4.58)
Clinical high glycosylated hemoglobin level			
No, %	31.8	15.9	6.3
Yes, %	59.0	41.0	27.1
AOR[a] (95% CI)	2.59 (1.60, 4.20)	3.23 (1.61, 6.48)	4.61 (2.90, 7.34)
AOR[b] (95% CI)	2.51 (1.51, 4.00)	3.12 (1.45, 6.74)	4.72 (2.90, 7.70)
Self-reported diabetes			
No, %	31.7	16.3	6.4
Yes, %	63.5	36.7	28.8
AOR[a] (95% CI)	3.19 (1.80, 5.67)	2.64 (1.37, 5.07)	5.07 (2.85, 9.02)
AOR[b] (95% CI)	3.10 (1.88, 5.11)	2.69 (1.22, 5.94)	4.54 (2.47, 8.35)
Clinical high cholesterol level			
No, %	32.7	16.7	6.1
Yes, %	39.2	20.6	12.1
AOR[a] (95% CI)	1.13 (0.85, 1.49)	1.14 (0.77, 1.67)	2.23 (1.40, 3.56)
AOR[b] (95% CI)	1.06 (0.78, 1.43)	1.14 (0.72, 1.81)	2.01 (1.27, 3.17)
Self-reported high cholesterol level			
No, %	32.8	17.2	6.2
Yes, %	45.4	22.4	17.9
AOR[a] (95% CI)	1.38 (0.76, 2.48)	1.19 (0.65, 2.16)	3.51 (1.82, 6.80)
AOR[b] (95% CI)	1.38 (0.76, 2.50)	1.19 (0.60, 2.36)	3.58 (1.92, 6.66)
Clinical high triglyceride level			
No, %	33.5	18.2	7.3
Yes, %	52.7	8.3	5.1
AOR[a] (95% CI)	1.89 (0.93, 3.86)	0.40 (0.16, 1.01)	0.75 (0.23, 2.38)
AOR[b] (95% CI)	1.41 (0.60, 3.31)	0.29 (0.10, 0.84)	0.62 (0.18, 2.10)

Note. AOR = adjusted odds ratio; CI = confidence interval.
[a]Adjusted for age and ethnicity (reference group = no).
[b]Adjusted for age, ethnicity, marital status, health insurance, body mass index, smoking, drinking, and physical activity (reference group = no).

have high blood pressure, but there was no difference in reporting of high blood pressure according to level of education. Moreover, although there was no difference in cholesterol level according to education level, the least-educated men were less likely to report high cholesterol.

As shown by Frijling et al.,[17] level of education is positively associated with awareness of health conditions and risk factors. People with lower levels of education—particularly men—may be less likely to be aware of their disease status and thus less likely to report the presence of disease. By contrast, among women, the least educated reported the presence of cardiovascular risk factors as frequently as the most educated. As observed by Brouwer and van Exel,[16] women seem to be more aware of their health, regardless of education level. Likewise, Kraywinkel et al.[21] showed that women were more likely to have better knowledge of stroke risk factors than were men.

Limitations

One of the limitations of our study is the cross-sectional study design. With longitudinal data, it would be of interest to analyze the interaction among education level, health status, and self-rated health by using measures of self-rated health over time. Another limitation is that only noninstitutionalized civilians were eligible to participate. This exclusion may lead to an underestimation of the interaction between education, self-rated health, and cardiovascular risk factors if the impact of institutionalization is worse on the self-rated health of more highly educated persons.

As in most epidemiological studies, the potential for incomplete adjustment for confounding exists. We used education level as a measure of socioeconomic position—an established variable in the literature—because it is attained earlier in life than is occupational class or income and consequently contributes to both, as shown by Lahelma et al.[22] Moreover, lifetime education level typically is attained before later life health problems, such as cardiovascular diseases. Therefore, reverse causality, corresponding to a negative impact of health status on socioeconomic position, is less likely with this indicator than with occupational class or income. Publicly accessible NHANES data in 2006 provided only 3 categories for education, so we were limited in our ability to further stratify our results and may have missed some within-group variations.

We did not adjust for all possible comorbid conditions. Comorbidities might have an effect on the relation between education and self-rated health and might affect the value of self-rated health as a confounder. However, because comorbidities are more frequent among people with low levels of education (in our study, these

people were more likely to have several cardiovascular risk factors), they could also be more likely to have a negative impact on self-rated health in this population. In that case, our reported results would be biased toward the null and taking comorbidities into account would increase the magnitude of the observed effect.

Conclusions

Our results show that education modifies the association between self-rated health and biological health variables, at least among women. This phenomenon might explain the results of 2 recent reports that demonstrated that lower health ratings were more strongly associated with mortality among adults with higher education.[7,8] Highly educated people tend to be more likely to report poor health status when a disease exists or a risk factor is present. Thus, among highly educated people, those who report good or very good self-rated health are less likely to have any disease or risk factors.

Poor self-rated health may be a more narrowly defined indicator of disease and mortality risk among more highly educated groups than among those with less education. This could be why self-rated health more accurately predicts mortality among highly educated people, and it could lead to an underestimation of the health inequalities existing between socioeconomic groups. To confirm these results, studies need to be conducted in other countries to verify that this interaction is stable across countries and cultures; however, the results also suggest that there are limitations in the use of self-rated health as an indicator of socioeconomic health inequalities. ■

About the Authors

Cyrille Delpierre, Valérie Lauwers-Cances, and Thierry Lang are with Inserm UMR558, Toulouse, France. Geetanjali D. Datta is with the Department of Epidemiology, Harvard School of Public Health, Boston, MA. At the time of the study, Lisa Berkman was with the Department of Society, Human Development and Health, Harvard School of Public Health, Boston.

Requests for reprints should be sent to Cyrille Delpierre, PhD, 37 allées Jules Guesde 31073, Toulouse, France (e-mail: cyrildelpierre@yahoo.fr).

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Contributors

C. Delpierre conducted the analysis and led the writing. V. Lauwers-Cances and G.D. Datta assisted with the study and analyses. L. Berkman and T. Lang supervised the study.

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Human Participant Protection

The 1999–2004 NHANES study was approved by the National Center for Health Statistics (protocol 98-12).

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