Health Insurance and Mortality

Evidence From a National Cohort

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Objective.—To examine the relationship between lacking health insurance and the risk of subsequent mortality.

Design.—Adults older than 25 years who reported they were uninsured or privately insured in the first National Health and Nutrition Examination Survey, a representative cohort of the US population, were followed prospectively from initial interview in 1971 through 1975 until 1987.

Participants.—Complete baseline and follow-up information was obtained on 4694 (91%) persons of the 5161 who reported not receiving publicly funded insurance at baseline.

Main Outcome Measure.—The relationship between insurance status and subsequent mortality was examined using Cox proportional hazards survival analysis. The analysis adjusted for gender, race, and baseline age, education, income, employment status, the presence of morbidity on examination, self-rated health, smoking status, leisure exercise, alcohol consumption, and obesity. The effects of interactions between insurance and all other baseline variables were also examined.

Results.—By the end of the follow-up period, 9.6% of the insured and 18.4% of the uninsured had died. After adjustment for all other baseline variables, the hazard ratio for lacking insurance was 1.25 (95% confidence interval [CI], 1.00 to 1.55). The effect of insurance on mortality was comparable to that of education, income, and self-rated health. There were no statistically significant ($P<.05$) interactions.

Conclusions.—Lacking health insurance is associated with an increased risk of subsequent mortality, an effect that is evident in all sociodemographic health insurance and mortality groups examined.

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THE NUMBER of uninsured persons has increased throughout the past decade,[1] reaching 35.4 million in 1991.[2] There are several reasons for this,[3] including a changing economy and in-

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creased costs of health care and insurance, making both less affordable both for employers and individuals. As a result, there has been widespread recent interest in ensuring health insurance for all Americans. There is limited systematic evidence that a lack of insurance results in adverse health outcomes, particularly mortality.[4]

It is well established that a lack of health insurance is associated with reduced access to medical care; persons without insurance report fewer physician visits, after adjusting for health status,[5-8] and report delaying or forgoing medical care for serious symptoms.[1,9-11]

Medicaid coverage has been shown to reduce this differential.[5,6,12,13] A lack of health insurance is also associated with a lower prevalence of recommended preventive services.[14,15] Other studies have found that uninsured persons compared with the insured are more likely to have potentially avoidable hospitalizations,[16,17] may be sicker at the time of hospital admission,[16,18,19] are more likely to experience in-hospital[20-22] and cancer mortality,[23] and are less likely to receive invasive procedures.[18,24] Many of these studies suggesting adverse outcomes do not include uninsured persons who have not entered the health care system, so that the results may simply represent adverse selection due to delayed access to care.

Some studies do point to health hazards associated with lacking health insurance. Braveman et al[25] studied hospital discharge data in California and found that adverse outcomes in newborns were more frequent in the uninsured. The use of hospital discharge data limited the ability of the authors to adjust for potential confounders. Some studies have shown that persons losing health insurance benefits suffer measurable declines in their health.[26-28] In the Rand Health Insurance Experiment, on average, persons randomized to both the health insurance copayment group and the free care group ended the study with similar levels of health.[29] For persons with poor vision and poor persons with high blood pressure, however, free care brought an improvement.[29] Though all persons enrolled in the Rand study had health insurance, these results suggest that financial barriers in the form of copayments resulted in clinically important adverse outcomes. Hubbell et al[30] found lower levels of functional sta-

tus among 94 poor patients with financial barriers to care compared with 94 control patients without financial barriers. Patrick et al[31] found that poor persons in families with all members uninsured compared with those from insured families had lower self-rated health and greater perceived need of services. Most studies have focused on the poor with the implication that the benefits from health insurance are limited to poor persons. Lack of insurance is correlated with low income, which is itself associated with poor health,[32-35] and most previous studies do not permit isolation of the effects of being poor from that of being uninsured. Many of the studies are cross-sectional in design, limiting confidence in the direction of the causal pathway. Finally, none of these studies have addressed the relationship between insurance and mortality.

Because of the limitations of studies addressing this important policy issue we examined the relationship between health insurance and mortality, using data from the National Health and Nutrition Examination Survey Epidemiologic Follow-up Study (NHEFS), which followed a representative cohort of the US population for up to 16 years. The rationale and analysis used in the present study was informed by the conceptual framework developed in a US Congress Office of Technology Assessment report.[4] The availability of health insurance is viewed as an enabling factor facilitating access to care. As noted above, persons lacking insurance have reduced access to care, evidenced by reduced use of a wide range of health services and self-reported forgone and delayed care.[1,5-7,9-11,14,15] In addition, the process of care for uninsured persons may be inferior. For example, the uninsured have an increased risk of suffering medical injury due to substandard care.[36] Consequent on reduced access and lower quality of care, we hypothesized that persons lacking insurance would experience increased mortality. Our analysis adjusted for the potentially confounding effect of other factors identified in the Office of Technology Assessment report as affecting health. These factors are categorized as predisposing (age, gender, education, employment, and race), need (perceived health and objective evidence of morbidity), other enabling (income), and individual behaviors (smoking status, alcohol consumption, leisure exercise, and obesity status).

METHODS

The first National Health and Nutrition Examination Survey (NHANES I), conducted between 1971 and 1975, col-

lected sociodemographic, health insurance and utilization, medical history, and clinical and laboratory information from several national probability samples of the civilian noninstitutionalized population.[37,38] Not all information was collected on all respondents. Detailed information including insurance status was collected on 6913 adults aged 25 to 74 years. Interviewees were also examined by physicians, who assigned up to 15 diagnoses based on history, physical examination, and the results of laboratory investigations. The NHEFS was designed to trace and reinterview respondents aged 25 to 74 years.[39] Follow-up surveys in NHEFS were conducted in 1982 through 1984, 1986, and 1987. Data collected comprised interview surveys, medical records from health care facilities, and death certificates for all decedents. The age, race, and sex-specific mortality of the NHEFS cohort is similar to that experienced by the US population.[40]

We analyzed data on adults who reported in NHANES that they did not receive publicly funded insurance. We excluded adults with Medicaid, Veterans Administration insurance, or Medicare to avoid confounding by poor adults whose health status may be compromised by the presence of significant disabilities.[41] Of the 6913 persons asked about their insurance status, 5218 reported that they were either uninsured or had private insurance. Vital status at follow-up was available on 4939 persons (95%). Compared with persons with vital status follow-up information, those unavailable for follow-up were younger and were more likely to be black men and white women.[42] We also excluded 57 persons whose race (mostly Asian and American Indian) was neither white nor black, because their number was too small to allow reliable analysis. The univariate analysis presented was thus based on a sample of 4882 persons. There were 188 persons (3.8%) with vital status information at follow-up who had incomplete baseline data, mostly missing family income data, so that the multivariate analyses were based on 4694 persons. Compared with persons with complete baseline data, those with incomplete baseline data were more likely to be uninsured (19.9% compared with 14.1%), older (61.8% compared with 52% were over 44 years of age for those with complete data), and have less than 12 years of school (45.7% compared with 34%).

Analyses

The NHANES I used multistage stratified probability samples of clusters of persons. In addition, persons liv-

ing in poverty areas, women of childbearing age, and elderly persons were oversampled. To accommodate the complex survey design the statistical package SUDAAN[43] was used in the analyses reported below. The SUDAAN program uses a Taylor series approximation method to compute variances that allow adjustment for the multistage probability sampling strategy. The revised weights provided on the 1987 NHEFS public use tapes were used to adjust for survey oversampling and nonresponse to yield population estimates of reported baseline descriptors. The univariate relationships between each baseline variable and health insurance status (dichotomized as reporting having no health insurance or having private health insurance) and mortality were examined using χ^2 tests. To examine the relationship between insurance status and subsequent mortality, proportional hazards survival analyses were used to adjust for other baseline variables, including the following: age (years); gender; race (dichotomized as white or black); education (dichotomized as at least 12 years of school or less); family income at baseline (treated as three dummy variables, income less than $7000 per year, $7000 to $9999 per year, and $10 000 to $14 999 per year, using income of $15 000 and higher per year as a reference); employment status (dichotomized as working most of the previous 3 months or not); morbidity (dichotomized as the presence or absence of evidence of morbidity on medical examination and laboratory testing); self-rated health (treated as three dummy variables, reporting health in general to be very good, good, or fair/poor with excellent as the reference value); smoking status (smoker or not); obesity status (dichotomized as body mass index [weight in kilograms divided by height in meters squared] >27 or not); leisure exercise (dichotomized as reporting little or no exercise compared with moderate or much); and alcohol consumption (dichotomized as consuming at least six alcoholic drinks per week or less). Because the family income variables were not adjusted for household size, the survival analyses also included household size as an interval level variable. In addition to a survival analysis including only main effects, a model with the interaction terms between insurance status and the other independent variables was examined. Interaction terms were retained if they were statistically significant ($P<.05$). To avoid the inefficiency of performing weighted multivariate analyses, we followed the recommendations of Korn and Graubard[44] to use unweighted survival analyses that

Table 1.—Relationships Between Health Insurance Status and Mortality and Selected Characteristics

Characteristic	No. (%)	% Uninsured* (SE)	% Died† (SE)
Vital status			
Died	593 (10.7)	22.1 (2.4)	...
Alive	4289 (89.3)	11.7 (0.7)	...
Insurance status			
Uninsured	699 (12.8)	...	18.4 (2.0)
Insured	4183 (87.2)	...	9.6 (0.5)
Age group, y			
≥55	1206 (28.8)	17.4 (3.9)	27.1 (1.6)
45-54	1354 (24.9)	11.2 (2.8)	10.9 (0.8)
35-44	1035 (24.8)	10.1 (2.4)	5.7 (0.8)
25-34	1287 (22.8)	13.0 (3.7)	2.0 (0.5)
Sex			
Male	2136 (46.6)	13.8 (1.0)	13.7 (0.8)
Female	2746 (53.4)	11.7 (0.9)	8.1 (0.5)
Race			
Black	517 (9.1)	23.4 (2.5)	14.7 (1.9)
White	4365 (90.9)	11.8 (0.7)	10.3 (0.5)
Education, y			
<12	1684 (31.5)	22.6 (1.4)	18.7 (1.2)
≥12	3198 (68.5)	8.4 (0.6)	7.0 (0.4)
Income, $			
<7000	950 (18.0)	34.7 (2.2)	19.2 (1.6)
7000-9999	1074 (25.1)	12.9 (1.1)	11.7 (1.0)
10 000-14 999	1283 (27.6)	6.4 (0.7)	7.6 (0.9)
≥15 000	1391 (29.3)	4.6 (0.9)	6.7 (0.7)
Employment status			
Unemployed	1796 (33.6)	20.3 (1.2)	12.9 (1.0)
Employed	3079 (66.4)	9.1 (0.7)	9.6 (0.5)
Self-rated health			
Fair or poor	825 (16.9)	27.6 (1.7)	24.7 (1.6)
Good	1532 (31.4)	13.2 (1.2)	12.4 (0.9)
Very good	1292 (26.5)	12.8 (1.0)	9.7 (0.9)
Excellent	1229 (25.2)	8.4 (0.9)	5.9 (0.8)
Morbidity			
Present	2922 (56.6)	15.7 (1.0)	14.9 (0.9)
Absent	1960 (43.4)	9.1 (1.0)	5.3 (0.6)
Leisure exercise			
Little or none	1885 (39.7)	15.3 (1.1)	12.8 (0.9)
More	2993 (60.3)	11.3 (0.9)	9.4 (0.6)
Smoking status			
Smoker	1968 (42.0)	14.3 (1.0)	13.4 (0.9)
Nonsmoker	2914 (58.0)	11.8 (0.9)	8.8 (0.5)
Alcohol consumption			
≥6 drinks per wk	1269 (27.0)	11.9 (1.3)	13.4 (1.0)
<6	3613 (73.0)	13.2 (0.8)	9.7 (0.6)
Obesity status‡			
BMI, >27	467 (9.3)	15.9 (1.8)	14.4 (1.7)
BMI, ≤27	4415 (90.7)	12.5 (0.7)	10.3 (0.5)

*Percentage of those with the characteristic who were uninsured at baseline.
†Percentage of those with the characteristic who died during the follow-up period. Percentages are weighted to provide population estimates, and SEs are adjusted for cluster sampling strategy.
‡BMI indicates body mass index (weight in kilograms divided by height in meters squared).
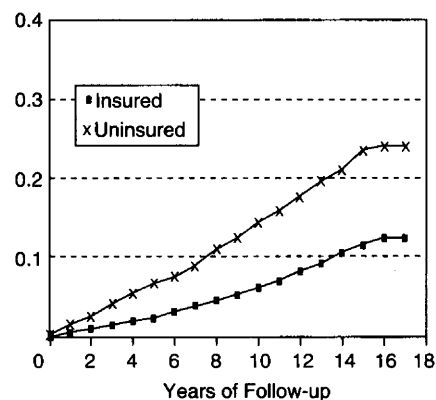

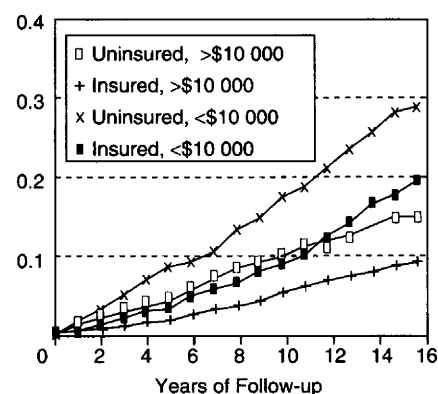Fig 1.—Cumulative mortality probability by baseline insurance category.

Fig 2.—Cumulative mortality probability by baseline insurance and income categories.

By the end of the follow-up period, 593 persons, representing 10.7% of the population, had died (Table 1). Those who died were nearly twice as likely to have been uninsured at baseline compared with those who survived (χ^2, 16.5; $P<.001$). Increased mortality was also associated with being older (χ^2, 228.8; $P<.001$), being a male (χ^2, 33.8; $P<.001$), black (χ^2, 8.9; $P<.001$), having less than 12 years of school (χ^2, 68.7; $P<.001$), lower income (χ^2, 49.4; $P<.001$), unemployment (χ^2, 9.8; $P=.003$), lower self-rated health (χ^2, 73.2; $P<.001$), morbidity present on baseline medical examination (χ^2, 66.4; $P<.001$), reporting little or no leisure exercise (χ^2, 8.9; $P=.004$), smoking (χ^2, 20.1; $P<.001$), consuming six or more drinks per week (χ^2, 11.0; $P=.001$), and obesity (χ^2, 4.9; $P=.03$). Figures 1 through 3 show the relationship between insurance status at baseline and the probability of mortality over the follow-up period, both unadjusted and stratified by income and morbidity. The adverse association between lacking insurance and mortality was observed in all subgroups.
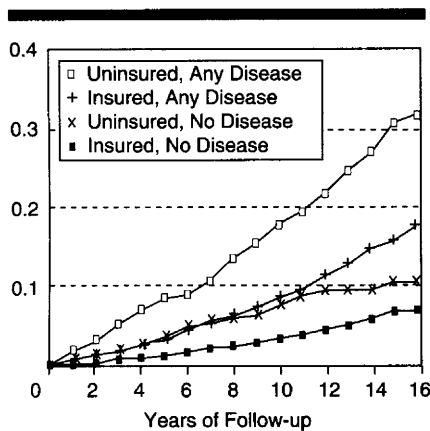
controlled for the variables used in determining the sample weights (age, gender, race, and income).

RESULTS

Baseline characteristics of the sample are shown in Table 1, which also provides population estimates for each characteristic. Not having health insurance was reported by 699 persons (12.8% of the population). Persons older than 55 years were more likely to be uninsured (χ^2, 26.1; $P<.001$), as were men (χ^2, 33.8;

$P<.001$), blacks (χ^2, 16.7; $P<.001$), those with less than 12 years of school (χ^2, 73.5; $P<.001$), those with lower family incomes (χ^2, 114.3; $P<.001$), the unemployed (χ^2, 78.8; $P<.001$), those reporting lower self-rated health (χ^2, 59.9; $P<.001$), those with morbidity found on medical examination (χ^2, 18.4; $P<.001$), and those reporting little or no leisure exercise (χ^2, 10.1; $P=.002$). There was no statistically significant ($P<.05$) relationship between insurance and smoking status, alcohol consumption, or obesity.

Fig 3.—Cumulative mortality probability by baseline insurance and morbidity categories.

Legend:
□ Uninsured, Any Disease
+ Insured, Any Disease
× Uninsured, No Disease
■ Insured, No Disease

X axis: Years of Follow-up (0 to 16)
Y axis: 0.1 to 0.4

Table 2.—Proportional Hazards Model for Survival Time Adjusted for Baseline Characteristics (N=4694)*

Baseline Risk Factor	Hazard Ratio (95% Confidence Interval)
No insurance	1.25 (1.55-1.00)
Age	1.07 (1.09-1.05)
Men	1.90 (2.40-1.50)
Black	1.36 (1.72-1.08)
<12 y school	1.32 (1.61-1.09)
Income	
<$7000	1.26 (1.66-0.96)
$7000-$9999	1.27 (1.67-0.97)
$10 000-$14 999	1.08 (1.48-0.79)
Unemployment	1.21 (1.59-0.99)
Morbidity present	1.43 (1.74-1.18)
Self-rated health	
Fair/poor	1.62 (2.21-1.18)
Good	1.25 (1.61-0.97)
Very good	1.21 (1.59-0.92)
Little or no exercise	1.14 (1.36-0.96)
Present smoker	1.84 (2.15-1.57)
BMI, >27†	1.40 (1.74-1.13)
≥6 drinks per wk	1.46 (1.78-1.20)

*Analysis also adjusted for household size. Baseline risk factors indicate the value of the baseline characteristic associated with higher mortality. Except where noted, the hazard ratio shows the adjusted hazard with the risk factor present compared with the risk factor absent; for age, the risk factor is a 1-year increment in age; each income group is compared with the income $15 000 or more reference group; each self-rated health group is compared with excellent self-rated health as the reference group.

†BMI indicates body mass index (weight in kilograms divided by height in meters squared).

After adjusting for all other baseline characteristics, the proportional hazards survival analysis revealed that lacking insurance at baseline was associated with an increased risk of mortality (hazard ratio, 1.25; 95% confidence interval [CI], 1.00 to 1.55; Table 2). None of the interactions between insurance status and the other baseline characteristics made statistically significant (P<.05) contributions to the regression model. When the employment, self-rated health, and morbidity variables were excluded, the adjusted hazard ratio for lacking insurance was 1.34 (95% CI, 1.07 to 1.69).

COMMENT

This analysis of a nationally representative cohort of the US population suggests that the mortality experience of Americans without health insurance is greater than those with insurance. The effect observed is comparable to that observed for education, income, employment status, and self-rated health. In this study and reported in previous studies, lack of insurance is associated with social and medical factors that increase the risk of poor health.[32-35] However, lacking insurance is associated with subsequent higher mortality independent of other risk factors. The relationship was observed in those with and without baseline morbidity and in those with higher and lower levels of income and education. The absence of statistically significant interactions in the survival analysis between health insurance and the other baseline characteristics suggests that the benefits of health insurance are not confined to particular subgroups. These results are consistent with a previous study of a nationally representative sample suggesting a beneficial association between insurance and health status in persons both below and above 200% of the federal poverty level.[45]

Two main causal pathways may explain the results observed in this prospective study. First, the relationship observed between lacking health insurance and increased mortality may be the result of both insurance and mortality being associated with a third unmeasured underlying variable. In particular, persons without health insurance may value health less than those with insurance. Consequently, persons placing less value on health may fail to get insurance and also experience higher mortality because of individual lifestyle factors. There is little evidence to support this hypothesis. Studies on the factors associated with having insurance suggest that most persons lack insurance because they cannot afford it rather than because they are unwilling to buy it.[4] In the 1987 National Medical Expenditure Survey, 76.9% of uninsured persons were in families with adult workers, and lacking insurance was associated primarily with employment factors such as industry type, size of establishment, and hourly wage.[46] The present study controlled for several health behaviors that are associated with mortality. These lifestyle factors exhibited only modest associations with the availability of insurance.

Second, the results are consistent with the study hypothesis that a lack of health insurance is causally related to a higher mortality rate, because of decreased access and lower quality of care. This hypothesis is in accordance with the re-

sults of previous studies, and the conclusions of the US Congress Office of Technology Assessment report.[4] For the most part, previous studies suggesting the benefits of health insurance have either focused on the poor[27,30,31] or suggested that the benefits of free health care are evident mostly in the poor.[29] Although poorer persons had a higher mortality rate, there was no evidence that the adverse effects of lacking insurance was limited to this group. Our analysis compared any level of insurance with no insurance and included a representative sample of adults not covered by publicly funded insurance programs; thus, the analysis may have been more sensitive to the effect of insurance than the Rand Health Insurance Experiment.[29]

The results obtained probably underestimate the relationship between insurance and mortality. First, many persons in the insured group may be underinsured. Farley found that over a quarter of insured persons under 65 years of age were inadequately protected against the possibility of large medical bills.[47] Second, insurance status was measured only once, at baseline, and no account could be taken of the impact of changes in insurance status over time. Migration of persons with and without insurance to the other group would tend to bias the observed association toward zero. Most persons older than 50 years at the beginning of the study would have been eligible for Medicare by the end of the follow-up period. Significant shifts in insurance status also occur during the course of a year. In the 1987 National Medical Expenditure Survey, 22.4% of persons younger than 65 years were uninsured at some time during the year, 16.1% to 17.2% were uninsured at any one period during the year, and 11.4% were uninsured throughout the year. Third, the variables included in the survival analysis may have resulted in overadjusting of the true relationship between insurance status and mortality. Over time, employment status may be a better measure of insurance than self-reported insurance status, since most persons obtain their insurance through employment.[46] Also, if lacking insurance adversely affects health, then adjusting for baseline health status will tend to reduce the observed relationship between health insurance and mortality. When the baseline employment and health status variables were excluded from the analysis, the relationship between insurance and mortality was increased. Although observational studies cannot exclude the possibility that unmeasured underlying variables explain the relationship between lacking

health insurance and adverse health outcomes, it is unlikely that a randomized trial will be conducted to address this important policy issue. Our analysis, consistent with previous studies suggesting an adverse impact of lacking insurance on health, provides evidence that lacking insurance also increases mortality in a nationally representative sample of adults. The existing "safety net" has failed to prevent this increased mortality. The findings support a policy imperative for universal health insurance to reduce both financial barriers to care and the risk of premature mortality.

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Health Insurance and Mortality—Franks et al **741**