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The Relationship of Health Insurance and Mortality: Is Lack of Insurance Deadly?

Steffie Woolhandler, MD, MPH, and David U. Himmelstein, MD

About 28 million Americans are currently uninsured, and millions more could lose coverage under policy reforms proposed in Congress. At the same time, a growing number of policy leaders have called for going beyond the Affordable Care Act to a single-payer national health insurance system that would cover every American. These policy debates lend particular salience to studies evaluating the health effects of insurance coverage. In 2002, an Institute of Medicine review concluded that lack of insurance increases mortality, but several relevant studies have appeared since that time. This article summarizes current evidence concerning the relationship of insurance and mortality. The evidence strengthens confidence in the Institute of Medicine's conclusion that health insurance saves lives: The odds of dying among the insured relative to the uninsured is 0.71 to 0.97.

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At present, about 28 million Americans are uninsured. Repeal of the Affordable Care Act would probably increase this number, while enactment of proposed single-payer legislation (1) would reduce it. The public spotlight on how policy changes affect the number of uninsured reflects a widespread assumption that insurance improves health.

A landmark 2002 Institute of Medicine (IOM) report on the effects of insurance coverage on the health status of nonelderly adults buttressed this assumption (2). The IOM committee responsible for the report found consistent evidence from 130 (mostly observational) studies that "the uninsured have poorer health and shortened lives" and that gaining coverage would decrease their all-cause mortality (2).

The IOM committee also reviewed evidence on the effects of health insurance in specific circumstances and medical conditions. It concluded that uninsured patients, even when acutely ill or seriously injured, cannot always obtain needed care and that coverage improves the uptake of essential preventive services and chronic disease management. The report found that uninsured patients with cancer presented with more advanced disease and experienced worse outcomes, including mortality; that uninsured patients with diabetes, cardiovascular disease, end-stage renal disease, HIV infection, and mental illness (the five other conditions reviewed in depth) had worse outcomes than did insured patients; and that uninsured inpatients received less and worse-quality care and had higher mortality both during their hospital stays and after discharge.

At the time of the IOM report, only one adequately controlled observational study had examined the effect of coverage on all-cause mortality. In this review, we summarize key evidence on this issue (Table 1), focusing on studies that have appeared since the IOM report and other previous reviews (3–6). Although not reviewed in detail here, more recent studies generally support the earlier reviews' conclusions that insurance coverage improves mortality in several specific conditions (such as trauma [7] and breast cancer [8]), augments the use of recommended care (9), and improves several measures of health status (10, 11).

Methods

We searched PubMed and Google Scholar on May 19, 2017, for English-language articles by using the following terms: "[(uninsured) or (health insurance) or (uninsurance) or (insurance)] and [(mortality) or (life expectancy) or (death rates)]." After identifying relevant articles, we searched their bibliographies and used Google Scholar's "cited by" feature to identify additional relevant articles. We limited our scope to articles reporting data on the United States, quasi-experimental studies of insurance expansions in other wealthy nations, and recent cross-national studies. We contacted the authors of 4 studies to clarify their published reports on mortality outcomes.

We excluded most observational studies that compared uninsured persons with those insured by Medicaid, Medicare, or the Department of Veterans Affairs because preexisting disability or illness can make an individual eligible for these programs. Hence, relative to those who are uninsured, publicly insured Americans have, on average, worse baseline health, thereby confounding comparisons. Conversely, comparisons of the uninsured to persons with private insurance (which is often obtained through employment) may be confounded by a "healthy worker" effect: that is, that persons may lose coverage because they are ill and cannot maintain employment. Nonetheless, most analysts of the relationship between uninsurance and mortality have viewed the privately insured as the best available comparator, with statistical controls for employment, income, health status, and other potential confounders.

Finally, we focus primarily on nonelderly adults because most studies have been limited to this group, and this group is likely to experience large gains or losses of coverage from health reforms. Since the advent of Medicare in 1966, almost all elderly Americans have been covered, precluding studies of uninsured seniors. Although Medicare's implementation may not have accelerated the secular decline in seniors' mortal-

ity (12), the relevance of this experience, which predates many modern-day therapies, is unclear.

Children have also been excluded from most recent analyses of the relationship of insurance to mortality. Deaths in this population beyond the neonatal period are so rare that studies would need to evaluate a huge number of uninsured children to reach firm conclusions, and high coverage rates make assembling such a cohort difficult. The few studies addressing the effect of insurance on child survival have found that coverage lowers mortality (13–15) and few policy leaders contest the importance of covering children.

RANDOMIZED, CONTROLLED TRIALS

Only one well-conducted randomized, controlled trial (RCT)–the Oregon Health Insurance Experiment (OHIE)–has assessed the effect of uninsurance on health outcomes (10, 16). In 2008, the state of Oregon opened a limited number of Medicaid slots to poor, able-bodied, uninsured adults aged 19 to 64 years. The state held a lottery among persons on a Medicaid waiting list, with winners allowed to apply for a slot. The OHIE researchers took advantage of this natural experiment to assess the effect of winning the lottery on the 74 922 lottery participants.

Many lottery winners did not enroll in Medicaid, and 14.1% of lottery losers obtained Medicaid through other routes (some also got private coverage). Hence, the difference in the "dose" of Medicaid coverage was modest, an absolute difference of about 25%; to adjust for this, the OHIE researchers multiplied outcome differences by about 4 (10).

At 1 year of follow-up, the death rate among lottery losers was 0.8%, and the winners' death rate was 0.032% lower, a "dose-adjusted" difference of 0.13 percentage points annually (17). This difference was not statistically significant, an unsurprising finding given the OHIE's low power to detect mortality effects because of the cohort's low mortality rate, the low dose of insurance, and the short follow-up.

The findings on other health measures, obtained from in-person interviews and brief examinations on a subsample of 12 229 individuals in the Portland area, help inform the mortality results. Most physical health measures were similar among lottery winners and losers in the subsample. However, winners had better self-rated health, were more likely to have diabetes diagnosed and treated with medication, and were much less likely to screen positive for depression (10). Medicaid coverage was associated with a nonsignificant decrease of 0.52 (95% CI, 2.97 to −1.93) mm Hg in systolic blood pressure and 0.81 (95% CI, 2.65 to −1.04) mm Hg in diastolic blood pressure (10). In addition to the low dose of insurance, these wide CIs reflect the lack of baseline blood pressure data; this precludes analyses that take advantage of paired measures on each individual, which would reduce the variance of estimates.

In sum, the OHIE yields a (nonsignificant) point estimate that Medicaid coverage reduced mortality by 0.13 percentage points, equivalent to a (nonsignificant) odds ratio of 0.84.

Key Summary Points

In several specific conditions, the uninsured have worse survival, and the lack of coverage is associated with lower use of recommended preventive services.

The Oregon Health Insurance Experiment, the only available randomized, controlled trial that has assessed the health effects of insurance, suggests that insurance may cause a clinically important decrease in mortality, but wide CIs preclude firm conclusions.

The 2 National Health and Nutrition Examination Study analyses that include physicians' assessments of baseline health show substantial mortality improvements associated with coverage. A cohort study that used only self-reported baseline health measures for risk adjustment found a nonsignificant coverage effect.

Most, but not all, analyses of data from the longitudinal Health and Retirement Study have found that coverage in the near-elderly slowed health decline and decreased mortality.

Two difference-in-difference studies in the United States and 1 in Canada compared mortality trends in matched locations with and without coverage expansions. All 3 found large reductions in mortality associated with increased coverage.

A mounting body of evidence indicates that lack of health insurance decreases survival, and it seems unlikely that definitive randomized, controlled trials can be done. Hence, policy debate must rely on the best evidence from observational and quasi-experimental studies.

Two older RCTs are also relevant to the effect of insurance and access to care on mortality, although neither directly compared insured and uninsured persons. In the RAND Health Insurance Experiment, random assignment to full (first-dollar) coverage reduced diastolic blood pressure by an average of 0.8 mm Hg ($P < 0.05$) relative to persons randomly assigned to plans that required cost sharing (18), an effect size similar to the blood pressure findings in the OHIE. Unlike the OHIE, the RAND Health Insurance Experiment obtained baseline blood pressure readings, allowing researchers to determine that for participants with hypertension at baseline, full coverage reduced diastolic blood pressure by 1.9 mm Hg, mostly because of better hypertension detection (19); the effect was larger among low-income (3.5 mm Hg) than high-income (1.1 mm Hg) participants (19).

The Hypertension Detection and Follow-up Program also suggests that removing financial barriers to primary care in populations with high rates of uninsur-

Table 1. Summary of Studies on Relationship Between Insurance Coverage and All-Cause Mortality*

Study, Year (Reference)	Participants	Information on Baseline Health	Estimated Mortality Effect of Coverage vs. Uninsured	Comments
RCTs				
Oregon Health Insurance Experiment, 2013, 2011, 2012 (10, 16, 17)	74 922 nondisabled adults on waiting list for Medicaid	Retrospective survey of a subsample; no baseline blood pressure or other measurements	OR, 0.84 (NS)	Study was underpowered because of crossovers between insured and uninsured groups, low mortality rate, short follow-up. Coverage was associated with nonsignificantly lower (0.81 mm Hg) average diastolic blood pressure
Quasi-experimental studies, population-based				
Sommers et al, 2012, 2017 (29, 30)	Nonelderly adults in states expanding Medicaid (Arizona, New York, Maine) and comparison states	None at individual level; compared trends in death rates in expansion with those in neighboring states	RR of death expansion/nonexpansion states, 0.939 ($P = 0.001$)	Study examined Medicaid expansions that preceded the ACA's expansions
Sommers et al, 2014 (31)	Nonelderly adults in Massachusetts and comparison counties	None at individual level; compared trends in death rates in Massachusetts with those in matched control counties	RR for death in Massachusetts counties/matched counties, 0.971 ($P = 0.003$)	The 2006 reform expanded Medicaid and implemented subsidized coverage for low-income persons
Hanratty, 1996 (51)	Newborns in Canadian provinces expanding coverage at different times	None at individual level; compared infant mortality trends pre- vs. postreform	RR for death, 0.95 or 0.96 ($P < 0.05$ for both)	Estimates varied slightly depending on how time trends were modeled
Quasi-experimental studies, clinic cohorts				
Lurie et al, 1984, 1986 (40, 41)	186 clinic patients terminated from Medicaid vs. 109 who remained eligible	Clinic-based data	OR at 1 y, 0.23 (NS)	Large effect probably reflects very high baseline risk. Among terminated patients with hypertension, average diastolic blood pressure increased 10 mm Hg at 6 mo vs. decrease of 5 mm Hg among controls ($P = 0.003$)
Fihn and Wicher, 1988 (42)	157 patients terminated from outpatient VA care vs. 74 controls	Clinic-based data	OR not calculable from published data; per authors, "at least 6% of terminated patients died"	Marked deterioration in blood pressure control among terminated patients
Quasi-experimental studies using longitudinal data from the Health and Retirement Study (26, 32-37)	Several cohorts followed for varying time periods from age ≥51 y	Repeated questionnaires linked to Medicare records and National Death Index; no examination or laboratory data	Conflicting results; some found lower deaths among insured, and others were null	Studies compared mortality before age 65 y and relative changes in death rates after acquisition of Medicare eligibility. Different analytic strategies yielded different conclusions
Population-based cohort follow-up studies				
Sorlie et al, 1994 (23)	CPS respondents 1982–1985	None other than being employed	HR for employed white women, 0.83 (NS); HR for employed white men, 0.77 ($P = 0.05$)	No data on smoking, health status or other non-demographic predictors of mortality at baseline
Franks et al, 1993 (27)	NHANES respondents 1971–1975	Surveys, physical examinations, and lab test results	HR, 0.8 ($P = 0.05$)	Controls for baseline health status included physician-assessed morbidity
Kronick, 2009 (24)	NHIS respondents 1986–2000	Questionnaires only	HR, 0.91 ($P < 0.05$; without control for self-rated health) and 0.97 (NS; including self-rated health)	Control for self-rated health may bias findings because this variable is probably confounded by coverage
Wilper et al, 2009 (28)	NHANES respondents 1988–1994	Surveys and physician-rated health after a physical examination	HR, 0.71 ($P < 0.05$)	Controls for baseline health status included physician-assessed health status

ACA = Affordable Care Act; CPS = Current Population Survey; HR = hazard ratio; NHANES = National Health and Nutrition Examination Study; NHIS = National Health Interview Survey; NS = nonsignificant; OR = odds ratio; RR = relative risk; VA = Department of Veterans Affairs.
* For studies not reporting ORs, HRs, or RRs, the authors computed them from data in the original report.

ance may reduce mortality. That population-based RCT carried out in the 1970s screened almost all residents of 14 communities, with oversampling of predominantly black and poor locations. Persons with hypertension were randomly assigned to free stepped care in special clinics or referral to usual care. Although the clinics' staff treated only hypertension-related problems, they provided informal advice and "friendly referrals" for other medical issues (20). Strikingly, all-cause mortality was reduced by 17% in the intervention group, with similar reductions in deaths due to cardiovascular and noncardiovascular conditions (21).

Finally, a flawed RCT carried out by the Social Security Administration starting in 2006 bears brief mention. That study randomly assigned people who were receiving Social Security disability income and were in the waiting period for Medicare coverage to receive immediate or delayed coverage (22). Unfortunately, randomization apparently failed, with many more patients with cancer assigned to the immediate coverage than to the control group, precluding reliable interpretation of the mortality results (11). Interestingly, persons receiving immediate coverage had rapid and significant improvements in most measures of self-reported health (11).

Mortality Follow-up of Population-Based Health Surveys

Several routinely collected federal surveys that include information about health insurance coverage have been linked to the National Death Index, allowing researchers to compare the mortality rates over several years of respondents with and without coverage at the time of the initial survey. One weakness of these studies is their lack of information about the subsequent acquisition or loss of coverage, which many people cycle into and out of over time. This dilutes coverage differences and may lead to underestimation of the effects of insurance coverage.

Sorlie and colleagues (23) analyzed mortality among respondents to the 1982–1985 Current Population Survey, with follow-up through 1987. In analyses limited to employed persons, the relative risk for death associated with being uninsured was 1.3 for white men and 1.2 for white women (neither overall figures nor those for minorities were reported) (23). The study's lack of data on important determinants of health, such as smoking, and its reliance on employment status as the only proxy for baseline health status weaken confidence in its conclusions.

Kronick used data from the 1986–2000 National Health Interview Surveys, with mortality follow-up through 2002 (24). The mortality hazard ratio for uninsured versus insured individuals was 1.10 (95% CI, 1.03 to 1.19) after adjustment for demographic variables, smoking, and body mass index. The hazard ratio fell to 1.03 (95% CI, 0.95 to 1.12) after additional adjustment for baseline health, defined by using self-reported disability and self-rated health. Although the self-rated health scale is known to be a valid predictor of mortality (25), it may introduce inaccuracies in comparisons of uninsured versus insured persons. Recent data (10, 11, 16, 26) indicate that gaining coverage improves self-rated health, before improvements in objective measures of physical health are detectable (or plausible). This suggests that uninsurance may cause people to underrate their health, perhaps because of anxiety or the inability to gain reassurance about minor symptoms. Analyses, such as Kronick's, that rely on self-rated health for risk adjustment therefore may inadvertently compare relatively sick insured persons to relatively healthy uninsured persons, obscuring outcome differences caused by coverage. Studies that include more objective measures of baseline health should be less subject to any such bias.

Mortality Follow-up of Population-Based Health Examination Surveys

Two studies have analyzed the effect of uninsurance on mortality using data from the National Health and Nutrition Examination Survey (NHANES), which obtains data from physical examination and laboratory tests among participants.

Franks and colleagues (27) analyzed the 1971–1975 NHANES, with mortality follow-up through 1987. They compared mortality of uninsured and privately insured adults older than age 25 years, adjusted for demographic characteristics, self-rated health, smoking, obesity, leisure time exercise, and alcohol consumption. In addition, their models controlled for evidence of morbidity determined by laboratory testing and medical examinations performed by NHANES staff. By 1987, 9.6% of the insured and 18.4% of the uninsured had died. After adjustment for baseline characteristics and health status, the hazard ratio for uninsurance was 1.25 (95% CI, 1.00 to 1.55).

Wilper and colleagues' study (which we coauthored) used data from the 1988–1994 NHANES, with mortality follow-up through 2000 (28). The study assessed mortality among uninsured and privately insured persons age 17 to 64 years, controlling for demographic characteristics, smoking, alcohol consumption, body mass index, leisure time activity, self-rated health, and physician-rated health after the NHANES physician completed the medical examination. The study also included sensitivity analyses adjusting for the number of hospitalizations and physician visits within the past year, limitations in work or activities, job or housework changes due to health problems, and number of self-reported chronic diseases, which yielded results similar to those of the main model. In the main model, being uninsured was associated with a mortality hazard ratio of 1.40 (95% CI, 1.06 to 1.84).

Quasi-experimental Studies of State and Provincial Coverage Expansions

In two similar studies (29, 30), Sommers and colleagues compared mortality trends in states that expanded coverage to low-income residents (before im-

plementation of the Affordable Care Act) with trends in similar states without coverage expansions.

Their analysis of Medicaid expansions in Maine, New York, and Arizona during the early 2000s found that adult mortality rates fell faster in those states than in neighboring ones (a relative reduction of 6.1%, or 19.6 deaths per 100 000), coincident with a decline in the uninsurance rate of 3.2 percentage points (29). Mortality reductions were largest among nonwhites, adults age 35 to 64 years, and poorer counties. Sommers and colleagues' subsequent reanalysis using data that allowed better matching to control counties yielded a slightly lower estimate of the mortality effect (30). As the authors note, the large mortality effect from a relatively modest coverage expansion may reflect the fact that Medicaid enrollment often occurred "at the point of care for patients with acute illnesses," leading to the selective enrollment of those most likely to benefit from coverage.

A study of the effect of Massachusetts' 2006 coverage expansion compared mortality trends in Massachusetts counties with those in propensity score–matched counties in other states. Mortality decreased by 2.9% in Massachusetts relative to the comparison counties, a difference of 8.2 deaths per 100 000 adults, with larger declines in poorer counties and those with lower coverage rates before the expansion (31).

Other Quasi-Experimental Studies

Several researchers have used data from the Health and Retirement Study (HRS)—a longitudinal study that has followed cohorts enrolled at age 51 years or older—to assess the effect of insurance coverage on mortality. The HRS periodically surveys respondents and their families and has been linked to Medicare and National Death Index data.

McWilliams and colleagues found significantly higher mortality rates among uninsured compared with insured HRS respondents, even after propensity score adjustment for multiple predictors of insurance coverage (32). Baker and colleagues found that respondents who were uninsured (compared with those who had private insurance) had higher long-term but not short-term mortality (33). After adjustment for multiple baseline characteristics, including instrumental variables associated with coverage (such as a spouse's union membership), Hadley and Waidmann found a strong positive association between insurance coverage and survival before age 65 years (34). Black and colleagues suggested, on the basis of a "battery of causal inference methods," that others overestimated the survival benefits of insurance and that uninsured HRS respondents had only slightly higher (adjusted) mortality than those with private coverage (35). Finally, studies have reached conflicting conclusions as to whether the health of previously uninsured persons improves (relative to those who were previously insured) after they reach age 65 years and become eligible for Medicare (26, 36). Overall, the preponderance of evidence from the HRS suggests that being uninsured is associated with some increase in mortality.

Some studies using other data sources suggest that death rates drop at age 65 years, coincident with the acquisition of Medicare eligibility (37, 38), whereas others do not (39).

Finally, several studies have assessed the relationship between insurance coverage and hypertension control, a likely mediator of any relationship between coverage and all-cause mortality. Lurie and colleagues (40) followed a cohort of 186 patients who lost Medicaid coverage because of a statewide policy change and a control group of 109 patients who remained eligible. Among those who lost coverage, 5 died within 6 months (compared with none in the control group; $P = .16$), and the average diastolic blood pressure of those with hypertension increased by 10 mm Hg (compared with a 5-mm Hg decrease in controls; $P = 0.003$) (40). At 1 year, 7 patients who had lost Medicaid and 1 control had died; blood pressure differences were slightly less marked than seen at 6 months (41). A similar study of patients terminated from Veterans Affairs outpatient care because of a budget shortfall found marked deterioration in hypertension control among the terminated patients relative to controls who maintained access (42). These clinic-based findings accord with cross-sectional population-based analyses of data from NHANES, which have found worse blood pressure control among uninsured than insured patients with hypertension (43–45).

Evidence From Other Nations and From Cross-National Studies

The United States lags behind most other wealthy nations in life expectancy and is the only one with substantial numbers of uninsured residents (46). Although many factors confound cross-national comparisons, a recent study suggests that worse access to good-quality health care contributes to our nation's higher mortality from medically preventable causes (so-called amenable mortality) (47). Similarly, a recent review of studies from many nations concluded that "broader health coverage generally leads to better access to necessary care and improved population health" (48).

Quasi-experimental studies assessing newly implemented universal coverage in wealthy nations have reached similar conclusions. For instance, Taiwan's rollout of a single-payer system in 1995 was associated with an accelerated decline in amenable mortality, particularly in townships where coverage gains were larger (49, 50). In Canada, a study exploiting the different dates on which provinces implemented universal coverage estimated that coverage expansion reduced infant mortality by about 5% ($P < 0.03$) (51).

Finally, a recent study of cystic fibrosis cohorts also suggests that coverage improves mortality. Such patients live, on average, 10 years longer in Canada than in the United States. Among U.S. patients, those without known coverage have the shortest survival; among

Table 2. **Why the Causal Relationship of Health Insurance to Mortality Is Hard to Study**

Deaths, especially from causes amenable to medical treatment, are rare among nonelderly adults, who account for most of the uninsured.
Because insurance might prevent death by slowing the decline in health over several years, short-term studies may underestimate its effects.
Many people cycle in and out of insurance diluting differences between groups.
Randomly assigning participants to no coverage is unethical in most circumstances.
Observational studies must address reverse causality. Illness sometimes causes people to acquire public insurance by qualifying them for Medicaid, Medicare, or Department of Veterans Affairs disability coverage. Conversely, illness may cause job loss and resultant loss of private coverage.
In cohort studies, adequate control for baseline health status is difficult, particularly in uninsured patients, whose lack of access lowers self-rated health and also causes less awareness of important risk factors, such as hypertension or hyperlipidemia.
Quasi-experimental studies, which exploit factors associated with coverage (such as policy changes), rest on unverifiable assumptions (e.g., that without a coverage expansion, mortality trends in states expanding coverage would parallel those in comparator state).

the privately insured, life expectancy is similar to that among patients in Canada (52).

Discussion

The evidence accumulated since the publication of the IOM's report in 2002 supports and strengthens its conclusion that health insurance reduces mortality. Several newer observational and quasi-experimental studies have found that uninsurance shortens survival, and a few with null results used confounded or questionable adjustments for baseline health. The results of the only recent RCT, although far from definitive, are consistent with the positive findings from cohort and quasi-experimental analyses.

Several factors complicate efforts to determine whether uninsurance increases mortality (Table 2). Randomly assigning people to uninsurance is usually unethical, and quasi-experimental analyses rest on unverifiable assumptions. Deaths are rare and mortality effects may be delayed, mandating large studies with long follow-up. Many people cycle into and out of coverage, diluting the effects of insurance. And statistical adjustments for baseline health usually rely on participants' self-reports, which may be influenced by coverage. Hence, such adjustments may under- or overadjust for differences between insured and uninsured persons.

Inferences about mechanisms through which insurance affects mortality are subject to even greater uncertainty. In some circumstances, coverage might raise mortality by increasing access to dangerous drugs (such as oral opioids) or procedures (such as morcellation hysterectomy). On the other hand, coverage clearly reduces mortality in several serious conditions, although few are common enough to have a detectable effect on population-level mortality. The exception is hypertension, which is prevalent among the uninsured and seems a likely contributor to their higher death rates. Although uncontrolled hyperlipidemia is also more common among the uninsured (44), the OHIE—the only RCT performed in the statin era—found no effect of coverage on cholesterol levels.

Finally, our focus on mortality should not obscure other well-established benefits of health insurance: improved self-rated health, financial protection, and reduced likelihood of depression. Insurance is the gateway to medical care, whose aim is not just saving lives but also relieving human suffering.

Overall, the case for coverage is strong. Even skeptics who suggest that insurance doesn't improve outcomes seem to vote differently with their feet. As one prominent economist (53) recently asked, "How many of the people who write such things . . . choose to just not bother getting their healthcare?"

From The City University of New York School of Urban Public Health at Hunter College, New York, New York, and Harvard Medical School, Boston, Massachusetts.

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Requests for Single Reprints: David U. Himmelstein, MD, 255 West 90th Street, New York, NY 10024; e-mail, dhimmels@hunter.cuny.edu.

Current author addresses and author contributions are available at Annals.org.

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Current Author Addresses: Dr. Woolhandler: 255 West 90th Street, New York, NY 10024.
Dr. Himmelstein: 255 West 90th Street, New York, NY 10024.

Author Contributions: Conception and design: S. Woolhandler, D.U. Himmelstein.
Analysis and interpretation of the data: S. Woolhandler, D.U. Himmelstein.
Drafting of the article: S. Woolhandler, D.U. Himmelstein.
Critical revision for important intellectual content: S. Woolhandler, D.U. Himmelstein.
Final approval of the article: S. Woolhandler, D.U. Himmelstein.
Statistical expertise: S. Woolhandler, D.U. Himmelstein.
Collection and assembly of data: S. Woolhandler, D.U. Himmelstein.