Uninsured and Dying Because of It:

Updating the Institute of Medicine Analysis on the Impact of Uninsurance on Mortality

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Summary

The absence of health insurance creates a range of consequences, including lower quality of life, increased morbidity and mortality, and higher financial burdens. This paper focuses on just one aspect of this harm—namely, greater risk of death—and seeks to illustrate its general order of magnitude.

In 2002, the Institute of Medicine (IOM) estimated that 18,000 Americans died in 2000 because they were uninsured. Since then, the number of uninsured has grown. Based on the IOM's methodology and subsequent Census Bureau estimates of insurance coverage, 137,000 people died from 2000 through 2006 because they lacked health insurance, including 22,000 people in 2006.

Much subsequent research has continued to confirm the link between insurance and mortality risk described by IOM. In fact, subsequent studies and analysis suggest that, if anything, the IOM methodology may underestimate the number of deaths that result from a lack of insurance coverage.

More broadly, these estimates should be viewed as reasonable indicators of the general magnitude of excess mortality that results from lack of insurance, not as precise "body counts." The true number of deaths resulting from uninsurance may be somewhat higher or lower than the estimates in this paper, but that number is surely significant.

The IOM methodology

The IOM's 2002 report, *Care Without Coverage: Too Little, Too Late,* described the considerable research showing that the absence of health coverage impedes access to care, which ultimately increases the risk of illness and death. Uninsured women with breast cancer, for example, have their disease diagnosed later during its development, when treatment is less effective (Ayanian et al. 1993; Roetzheim et al. 1999, 2000; Lee-Feldstein et al. 2000; cited in IOM 2002). Uninsured men with hypertension are more likely to go without screenings and prescribed medication and to skip recommended doctor visits, increasing the likelihood of serious harm (Ayanian et al. 2000; Keeler et al. 1985; Huttin, Moeller, and Stafford 2000; Fish-Parcham 2001; cited in IOM 2002).

As part of the IOM report, the authors sought to estimate the total number of deaths resulting from uninsurance. They began developing this estimate with two long-term, longitudinal studies observing the relationship between insurance status and death rates. One used 1971–87 data on 25- to 74-year-olds from the National Health and Nutrition Examination Survey (Franks, Clancy, and Gold 1993). The other used Current Population Survey (CPS) data on 25- to 64-year-olds from 1982 to 1986 (Sorlie et al.1994). Although the two study populations differed, as did the potentially confounding characteristics for which the researchers controlled, both studies yielded estimates attributing to uninsurance an overall increase of 25 percent in mortality risk for working-age adults.

The IOM study combined this research result with information on the numbers of deaths and the percentages of people who are insured by 10-year age intervals. IOM researchers developed the following formula, which starts with the straightforward proposition that the number of total deaths in an age group is the sum of (a) deaths among *insured* members of that age group and (b) deaths among *uninsured* members of that age group.

$$DT = DI + DU$$
$$= (PI*X) + (PU*X*1.25), \text{ where}$$

DT = total deaths in a particular age cohort

DI = deaths among the insured in the age cohort

DU = deaths among the uninsured in the age cohort

PI = percentage insured in the age cohort

PU = percentage uninsured in the age cohort

X = the number of deaths that would occur if everyone in the age cohort had insurance.

Note that *DU*, or the number of deaths among the uninsured, is calculated through two steps. First, the IOM methodology ascertains the number of deaths among the uninsured as if everyone in the age cohort had insurance. That number is *X* (or the total number of deaths if everyone in the age cohort had insurance) times *PU* (or the proportion of people in the age cohort who lack insurance). Second, the number of deaths as if the uninsured had insurance is multiplied by 1.25. This yields an estimate of the actual number of deaths among the uninsured, reflecting the 25 percent higher mortality rate among the uninsured found by the above-described research.

Using the IOM's analysis of 25- to 34-year-olds to illustrate this calculation, mortality estimates from the National Center for Health Statistics (NCHS) showed that 40,548 adults age 25–34 died in 2000. Accordingly, for this age group, *DT* = 40,548.

At the time of the IOM report, data from the CPS reported that 79 percent of adults age 25–34 were insured and 21 percent were uninsured in 2000, providing the values for *PI* and *PU*, respectively. Using these figures in the above formula produces the equation:

$$40{,}548 = (.79*X) + (.21*1.25*X) = (.79*X) + (.26*X) = (.79+.26)*X = 1.05*X$$

Accordingly, *X* (the number of deaths if everyone in this age group had insurance) was 40,548 divided by 1.05, or 38,617. The number of deaths resulting from uninsurance was the actual number of deaths (40,548) minus the number of deaths that would have resulted without any uninsured (38,617), or 1,930.[1]

Pursuing that same analysis with each 10-year age cohort, IOM concluded that approximately 18,000 deaths resulted from uninsurance in 2000 (table 1).

Applying the IOM methodology to more recent Census estimates of the number of uninsured

Applying the IOM's methodology to the most recent Census Bureau estimates of the annual number of uninsured yields an estimate that 137,000 adults age 25–64 died because of uninsurance from 2000 through 2006, including 22,000 people in 2006 (table 2). This represents an average of one death every 24 minutes.

An alternative calculation

The IOM analysis may have underestimated the number of deaths resulting from uninsurance. The underlying longitudinal studies on which IOM relied did not specify the impact of insurance coverage on mortality by 10-year age groups. Rather, they documented the relationship between insurance and mortality across the sum total of all surveyed age groups.[2] The IOM's methodology implicitly assumed that insurance reduces mortality by the identical percentage for each 10-year age band, which the underlying research did not show. More grounded in the research would be an application of differential mortality estimates to all adults age 25–64, as was done for those longitudinal

TABLE 1. IOM estimates of the number of deaths resulting from uninsurance among adults age 25–64: 2000

Age	U.S. population (millions)	Percent uninsured within age group	Total deaths	Uninsured excess deaths
25–34	37,440	21%	40,548	1,930
35–44	44,780	15%	89,202	3,431
45–54	38,040	12%	162,545	4,734
55–64	23,784	14%	243,049	8,219
Total	144,044	16%	535,344	18,314

Source: IOM (2002).

TABLE 2. Estimated number of deaths resulting from uninsurance among adults age 25–64, applying the IOM methodology to the Census Bureau's most recent insurance totals: 2000–06

Year	Population age 25–64 (millions)	Percent uninsured	Total deaths	Uninsured excess deaths
2000	146.1	15.5%	536,000	17,000
2001	147.8	16.1%	549,000	18,000
2002	150.3	17.1%	563,000	19,000
2003	151.5	17.7%	572,000	20,000
2004	153.4	17.6%	571,000	20,000
2005	155.6	18.1%	589,000	21,000
2006	157.7	18.7%	602,000	22,000
Total				137,000

Sources: March Current Population Survey, 2001–07; National Center for Health Statistics, final death rates for 2000–04 and preliminary death rates for 2005. Calculations shown in appendix.

Notes: Numbers are rounded to the nearest 1,000. Totals may not add correctly because of rounding. This table's estimate for uninsured excess deaths in 2000 is slightly lower than the total published by the IOM because this table reflects the Census Bureau's downward adjustment of the number of uninsured from 2000 through 2005. In addition, the estimates in this table are based on estimates of the civilian population, and the IOM numbers included active-duty military; this table's estimates are based on weights derived from the 2000 Census, rather than the 1990 Census; and the table's estimates incorporate the NCHS's final death rate estimates for 2000, rather than the estimates for 1999 used by IOM.

TABLE 3. Using an alternative calculation, estimated number of deaths resulting from uninsurance among adults age 25–64: 2000–06

Year	Excess deaths due to uninsurance
2000	20,000
2001	21,000
2002	23,000
2003	24,000
2004	24,000
2005	25,000
2006	27,000
Total:	165,000

Sources: March Current Population Survey, 2001–07; National Center for Health Statistics, final death rates for 2000–04 and preliminary death rates for 2005.

Notes: Numbers are rounded to the nearest 1,000. Totals may not add correctly because of rounding. This table displays the results of calculations that modify the IOM methodology by estimating excess deaths for 25–64-year-olds as a whole rather than for each 10-year age cohort among 25–64-year-olds.

studies, rather than separately to each age group within this range. For 2000–06, this alternative approach raises the estimated number of excess deaths by an average of 20.5 percent a year.[3] Table 3 shows the results of those calculations.

New research confirms the link between insurance status and risk of death

Since publication of the IOM study, a growing body of research has continued to document a strong relationship between health coverage and health outcomes, including mortality. For example, several studies have used Health and Retirement Survey data to analyze the impact of insurance status on older adults. Examining data for adults age 55–64 from 1992 through 2000, one study found that, based on the kind of observational data employed by the studies on which IOM relied, providing all such adults with insurance coverage would have lowered the number of deaths by 27 percent. After controlling for the impact of health status on insurance coverage, the mortality reduction reached 42 percent (Hadley and Waidmann 2006). Using a broader measure of health outcomes, another study examining Health and Retirement Survey data found similar results (Dor, Sudano, and Baker 2006). Not only did these studies show the impact of insurance status on morbidity and mortality, they discovered that, after adjusting for the effect of health on the likelihood of having insurance, insurance was found to have a substantially more pronounced effect on morbidity and mortality. Because the studies on which the IOM relied did not compensate for this relationship, they may have understated the impact of insurance on mortality.

Another study using Health and Retirement Survey data for adults age 55–64 found that, after controlling for socioeconomic status and other factors, uninsurance increased such older adults' risk of dying over an eight-year period from 7.5 percent to 10.5 percent. The study thus estimated that, among such near-elderly adults alone, more than 13,000 people die every year due to uninsurance, "plac[ing] uninsurance third on a list of leading causes of death for this age group, below only heart disease and cancer" (McWilliams et al. 2004).

Using a different data source encompassing a broader age range of survey respondents, other researchers analyzed data for 15,792 adults age 45–64 from the Atherosclerosis Risk in Communities Study, a prospective cohort study sponsored by the National Heart, Lung and Blood Institute. After controlling for multiple factors, the study concluded that uninsurance increased mortality rates by 26 percent (Fowler-Brown et al. 2007)—a result strikingly similar to the 25 percent mortality rate differential found by the studies on which IOM relied. As with the earlier, longitudinal studies cited by IOM, the Fowler-Brown research may have underestimated the impact of insurance coverage on mortality because it did not control for the relationship between health status and likelihood of obtaining insurance.

Studies of particular health conditions have likewise continued to find a strong relationship between uninsurance and mortality. One analysis examined stroke, the country's third-leading cause of death. Based on 2002 hospital discharge data for adults age 18 and older, researchers found that, after controlling for socioeconomic status and other confounding variables, the absence of insurance increased the risk of death by 24 percent or 56 percent, depending on the type of stroke involved (Shen and Washington 2007). Another study examined records of all cancer cases diagnosed in Kentucky from 1995 through 1998. After controlling for demographic factors, stage of diagnosis, and initial treatment, the study found that uninsurance increased risk of death from lung and female breast cancer by 19 percent and 44 percent, respectively (McDavid et al. 2003).

On the other hand, Kronick (2003) raised questions about the earlier studies on which IOM relied, suggesting that unobserved variables such as obesity, use of tobacco and alcohol, wealth, and the value placed on health could have played a role inflating the apparent impact of insurance on mortality. If it had been possible to control for such variables, a less robust effect may have been observed, Kronick suggested.

However, since those earlier studies criticized by Kronick, additional research controlling for many previously unobserved factors has continued to confirm a strong link between insurance status and mortality risk. Among the articles cited above, for example, Hadley and Waidmann controlled for alcohol use, tobacco use, disability, self-reported health status, and chronic health conditions; Fowler-Brown and colleagues controlled for obesity, smoking, self-reported health status, cholesterol levels, and chronic medical conditions; and the study by McWilliams and colleagues controlled for alcohol use, obesity, exercise habits, marital status, disability, chronic medical conditions, job stress, and wealth. The latter research team further conducted a sensitivity analysis showing "that the confounding effect of unmeasured variables would have to be even greater than the impact of smoking on mortality in our study for the increased mortality of uninsured adults to become statistically nonsignificant" (McWilliams et al. 2004).

More broadly, even if unobserved variables mean that lack of insurance increases the risk of death by less than 25 percent, the consequences of uninsurance could still be serious. For example, applying a 15 percent increased mortality risk to all adults age 25–64, without distinction by age cohort, yields an estimate that uninsurance caused 101,000 excess deaths since the start of the decade, including 16,000 deaths in 2006.

Limitations of the current analysis

At the most basic level, the above estimates are not precise "body counts." Rather, the reader should view them as reasonable indicators of the general magnitude of excess mortality that results from uninsurance.

More narrowly, two limitations apply to this paper's estimates for 2004 through 2006. First, the NCHS has not yet published final death rates for 2005 or either preliminary or final death rates for 2006. This paper's estimates of excess mortality for 2005 and 2006 accordingly apply NCHS's preliminary death rates for 2005.

Second, the Census Bureau's count of the number of uninsured in 2004 and subsequent years differs from prior years because of a Census Bureau revision to the assignment of dependent coverage on the CPS. This discontinuity necessarily affects the mortality estimates in this paper, since the Census Bureau has not released modified versions of its pre-2004 data. However, this revision lowered the estimated number of uninsured adults age 25–64 by less than 1 percent. The discontinuity for this particular population accordingly does not appear large.

The Census Bureau made a larger correction to the assignment of dependent coverage on the CPS in March 2007 and released modified estimates of uninsurance based on this correction for all years covered in this report, which this paper incorporates. Accordingly, the Bureau's more recent and larger correction is fully reflected in all the analysis presented here.

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Appendix: Replicating the IOM methodology

This appendix explains the calculations involved in applying the IOM methodology to more recent estimates of uninsurance and death rates, with the results displayed in table 2 above. To replicate the IOM analysis, we began with estimates for 2000–06 of the total size of the population in each 10-year age band as well as the percentage of individuals in each age group who lacked insurance. We then applied the NCHS death rate estimates to the population estimates from CPS, thereby arriving at an estimated number of total deaths within each age cohort. At that point, we applied the algebra described in the text to ascertain the number of excess deaths attributable to uninsurance. Appendix tables 1 through 6 show the resulting numbers for each age group and year.

APPENDIX TABLE 1. IOM estimates of excess deaths in 2000 among uninsured adults age 25–64, updated to reflect revised census bureau estimates of uninsurance

Age	U.S. population (millions)	Percent uninsured within age group	Total deaths	Uninsured excess deaths
25–34	38.5	21.6%	39,086	2,001
35–44	44.3	15.2%	88,062	3,232
45–54	38.6	11.6%	164,477	4,645
55–64	24.7	12.3%	244,701	7,294
Total	146.1	15.5%	536,325	17,171

Sources: Urban Institute analysis of March 2001 Current Population Survey; National Center for Health Statistics, final death rates for 2000.

Note: As explained in the body of the report, the Census Bureau recently released revised estimates of the number of uninsured in 2000. Since the resulting number of uninsured for 2000 is lower than the Census Bureau's estimate at the time of the IOM report, this table's estimated number of excess deaths due to uninsurance is lower than the 18,000 estimate published by IOM.

APPENDIX TABLE 2. Estimates of excess deaths among uninsured adults age 25–64 for 2001, based on the IOM methodology

Age	U.S. population (millions)	Percent uninsured within age group	Total deaths	Uninsured excess deaths
25–34	38.4	23.0%	40,399	2,199
35–44	44.0	15.9%	89,590	3,432
45–54	39.5	12.5%	169,350	5,147
55–64	25.9	11.8%	249,507	7,151
Total	147.8	16.1%	548,846	17,929

Sources: Urban Institute analysis of March 2002 Current Population Survey; National Center for Health Statistics, final death rates for 2001.

APPENDIX TABLE 3. Estimates of excess deaths among uninsured adults age 25–64 for 2002, based on the IOM methodology

Age	U.S. population (millions)	Percent uninsured within age group	Total deaths	Uninsured excess deaths
25–34	38.9	24.5%	40,347	2,332
35–44	43.8	17.4%	88,859	3,699
45–54	40.2	13.3%	172,704	5,538
55–64	27.4	11.6%	260,743	7,359
Total	150.3	17.1%	562,654	18,928

Sources: Urban Institute analysis of March 2003 Current Population Survey; National Center for Health Statistics, final death rates for 2002.

APPENDIX TABLE 4. Estimates of excess deaths among uninsured adults age 25–64 for 2003, based on the IOM methodology

Age	U.S. population (millions)	Percent uninsured within age group	Total deaths	Uninsured excess deaths
25–34	38.9	26.1%	40,284	2,467
35–44	43.3	18.0%	87,232	3,751
45–54	41.0	13.7%	177,627	5,890
55–64	28.4	11.8%	266,791	7,621
Total	151.5	17.7%	571,934	19,729

Sources: Urban Institute analysis of March 2004 Current Population Survey; National Center for Health Statistics, final death rates for 2003.

APPENDIX TABLE 5. Estimates of excess deaths among uninsured adults age 25–64 for 2004, based on the IOM methodology

Age	U.S. population (millions)	Percent uninsured within age group	Total deaths	Uninsured excess deaths
25–34	39.0	25.0%	39,809	2,346
35–44	43.1	18.4%	83,315	3,656
45–54	41.9	14.1%	178,781	6,070
55–64	29.5	11.9%	268,739	7,777
Total	153.4	17.6%	570,644	19,850

Sources: U.S. Census Bureau, March 2005 Current Population Survey; National Center for Health Statistics, final death rates for 2004.

Note: Uninsurance estimates for 2004 and subsequent years may not be comparable to estimates for prior years because of corrections made by the Census Bureau in August 2006 to the assignment of dependent coverage on the March Supplement to the CPS.

APPENDIX TABLE 6. Estimates of excess deaths among uninsured adults age 25–64 for 2005, based on the IOM methodology

Age	U.S. population (millions)	Percent uninsured within age group	Total deaths	Uninsured excess deaths
25–34	39.1	26.0%	40,814	2,488
35–44	42.8	18.4%	82,728	3,646
45–54	42.7	14.6%	184,322	6,482
55–64	31.0	12.4%	280,734	8,411
Total	155.6	18.1%	588,598	21,028

Sources: U.S. Census Bureau, March 2006 Current Population Survey; National Center for Health Statistics, preliminary death rates for 2005.

Note: Uninsurance estimates for 2004 and subsequent years may not be comparable to estimates for prior years because of corrections made by the Census Bureau in August 2006 to the assignment of dependent coverage on the March Supplement to the CPS.

APPENDIX TABLE 7. Estimates of excess deaths among uninsured adults age 25–64 for 2006, based on the IOM methodology

Age	U.S. population (millions)	Percent uninsured within age group	Total deaths	Uninsured excess deaths
25–34	39.6	27.1%	41,291	2,616
35–44	42.5	18.9%	82,106	3,697
45–54	43.4	15.3%	187,251	6,903
55–64	32.2	12.7%	291,720	8,995
Total	157.7	18.7%	602,368	22,211

Sources: U.S. Census Bureau, March 2007 Current Population Survey; National Center for Health Statistics, preliminary death rates for 2005.

Notes: Uninsurance estimates for 2004 and subsequent years may not be comparable to estimates for prior years because of corrections made by the Census Bureau in August 2006 to the assignment of dependent coverage on the March Supplement to the CPS. Preliminary death rates for 2005 were used because, when the calculations for this table were done, NCHS had not published preliminary or final death rate estimates for 2006.

Endnotes

1 Numbers do not add to totals because of rounding.

2 The sample sizes were probably not enough to yield reliable estimates for 10-year age bands. The study by Franks and colleagues used data from the National Health and Nutrition Examination Survey, with a cohort that included 1,287 respondents age 25–34, 1,035 respondents age 35–44, and so on. These cohorts were not large enough to estimate the impact of insurance status after controlling for gender, race, education, income, employment status, self-rated health, morbidity, exercise levels, smoking status, alcohol consumption, and obesity. The much larger CPS sample studied by Sorlie and colleagues was not large enough to yield valid estimates for blacks, much less for the smaller number of adults within various 10-year age bands.

3 This happens because younger adults are more likely to be uninsured, while older adults have higher mortality rates. In the studies on which IOM relied, the higher mortality rates for older adults and the higher uninsurance rates for younger adults were, in effect, distributed across the entire age range. That same effect arises when the IOM equations are applied evenly throughout the entire population of adults age 19–64, as this paper recommends, based on the uninsurance rate and the mortality rate of the *entire group*. It does not arise when the equations are applied separately to every 10-year age cohort, each with its own uninsurance and mortality rates.

The following hypothetical illustrates this peculiar result. Consider an imaginary group of 50,000 younger adults and 50,000 older adults with the following characteristics:

50 percent of the younger adults—or 25,000—are uninsured. 10 percent of the older adults—or 5,000—are uninsured. Altogether, 30,000 of the 100,000 adults—or 30 percent—are uninsured.

1 percent of the younger adults—or 500 people—die each year. 10 percent of the older adults—or 5,000—die each year. Altogether, 5,500 of the 100,000 adults—or 5.5 percent—die each year.

To condense the algebraic explanation in the text, the IOM's methodology determines the number of excess deaths due to uninsurance based on the following equation: $ED = DT - (DT/(PI + (PU*1.25)))$, where:

ED = the number of excess deaths due to uninsurance
DT = total deaths
PI = percentage of insured individuals
PU = percentage of uninsured individuals

In our hypothetical, this equation can be applied either to the entire group at once or to each age cohort separately.

A single group-wide application. Applying this equation to the entire group of all adults, with a single consolidated death rate and a single consolidated rate of uninsurance, yields the estimate that 384 adults died because of uninsurance. For the group as a whole, ED = 5,500– (5,500/(70%+(30%*1.25))) = 5,500– (5,500/(70%+37.5%)) = 5,500– (5,500/1.075) = 5,500–5,116.3 = 383.7.

Multiple cohort-specific applications. Applying this equation separately to younger adults and older adults, each group with its own death rate and uninsurance rate, yields the quite different conclusion that approximately 178 adults died because of uninsurance, including 56 younger adults and 122 older adults:

Among younger adults, ED = 500– (500/(50%+(50%*1.25))) = 500– (500/(50%+62.5%) =
500– (500/1.125) = 500–444.4 =55.6

Among older adults, ED = 5,000–(5,000/(90%+(10%*1.25))) =
5,000– (5,000/(90%+12.5%) = 5,000–(5,000/1.025) = 5000–4,878.0 = 122.0

Analysis. To yield the same number of deaths as the single groupwide application, the cohort-specific applications would need to apply either (a) to both cohorts, a common estimate that uninsurance increases risk of death by 57.5 percent, or (b) for each cohort, a different estimate for the impact of uninsurance on risk of death (e.g., 75 percent increase for older adults and 15 percent increase for younger adults). *What does not yield the same number of deaths is applying to each age cohort the groupwide estimate for the impact of uninsurance on risk of death*.

The longitudinal studies on which IOM relied derived a single, groupwide estimate that uninsurance increased the risk of death among all working-age adults by 25 percent. To apply such groupwide findings consistently with those studies requires groupwide, rather than cohort-specific, calculations.

In theory, cohort-specific calculations make more sense because they take into account that the adults least likely to be uninsured have the highest mortality rates. Accordingly, such calculations will be preferred when the research matures to the point of providing consistent documentation of a full range of age-cohort-specific estimates of the impact of uninsurance on mortality. However, since current research documents the impact of uninsurance on mortality across the full set of working-age adults, the calculations of excess deaths likewise need to take place across that full set if they are to remain optimally grounded in the research.

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