An Official American Thoracic Society Systematic Review: The Association between Health Insurance Status and Access, Care Delivery, and Outcomes for Patients Who Are Critically Ill

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THIS OFFICIAL SYSTEMATIC REVIEW OF THE AMERICAN THORACIC SOCIETY WAS APPROVED BY THE ATS BOARD OF DIRECTORS, OCTOBER 2009

Rationale: **One in three Americans under 65 years of age does not have health insurance during some portion of each year. Patients who are critically ill and lack health insurance may be at particularly high risk of morbidity and mortality due to the high cost of intensive care.**

Objectives: **To systematically review the medical and nonmedical literature to determine whether differences in critical care access, delivery, and outcomes are associated with health insurance status.**

Methods: **Nine electronic databases (inception to 11 April 2008) were independently screened and abstracted in duplicate.**

Measurements and Main Results: **From 5,508 citations, 29 observational studies met eligibility criteria. Among the general U.S. population, patients who were uninsured were less likely to receive critical care services than those with insurance (odds ratio [OR], 0.56; 95% confidence interval [CI], 0.55–0.56). Once admitted to the intensive care unit, patients who were uninsured had 8.5% (95% CI, 6.0–11.1) fewer procedures, were more likely to experience hospital discharge delays (OR 4.51; 95% CI, 1.46–13.93), and were more likely to have life support withdrawn (OR 2.80; 95% CI, 1.12–7.02). Lack of insurance may confer an independent risk of death for patients who are critically ill (OR 1.16; 95% CI, 1.01–1.33). Patients in managed care systems had 14.3% (95% CI, 11.5–17.2) fewer procedures in intensive care, but were also less likely to receive "potentially ineffective" care. Differences in unmeasured confounding factors may contribute to these findings.**

Conclusions: **Patients in the United States who are critically ill and do not have health insurance receive fewer critical care services and may experience worse clinical outcomes. Improving preexisting health care coverage, as opposed to solely delivering more critical care services, may be one mechanism to reduce such disparities.**

Keywords: insurance; disparities; payer; critical care; intensive care; access; outcome; Medicare; managed care; Medicaid

CONTENTS

One in three Americans under 65 years of age does not have health insurance during some portion of each year (1). Lack of insurance has previously been linked to decreased access to primary and ambulatory care (2–5). For patients diagnosed with certain chronic illnesses or suffering from unintentional injury, the uninsured are also more likely to suffer worse outcomes than their insured counterparts (6). The impact of health insurance status on access to and delivery of critical care is not well established, but any impact would be of particular concern because critical illness requires immediate life-supporting treatment, denial of which may lead to avoidable injury and death. Although U.S. legislation prohibits hospitals from refusing care to emergently ill individuals who do not have adequate insurance coverage, evidence suggests that this practice may still occur (7, 8).

Disparities may not be limited to the uninsured but may also exist among the insured, depending on details of the coverage. In 2006, 159 million Americans were enrolled in managed care programs whose cost-management and resource-utilization policies differ from traditional indemnity insurance. These policy differences may also influence access to and delivery of care. Differences in reimbursement methods for insurance coverage, as well as different healthcare systems, may also influence access to care and care delivery for critically ill patients. We conducted a systematic review of the medical and nonmedical literature to determine whether there is an association between various types or lack of health insurance and access to, delivery of, and outcomes of critical care.

METHODS

Eligibility Criteria

Our goal was to identify all studies from the medical and nonmedical literature that described access to care, care delivery, or outcomes for critically ill adults, and that compared

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two or more methods of payment or insurance states for these patients. Very few randomized controlled trials of payer status have been done (9); most studies were observational in design. Hence, we followed recommendations of the Meta-analysis of Observational Studies in Epidemiology (MOOSE) group for conducting systematic reviews of observational studies (10). Case series and narrative reviews were not included due to their potential for bias.

Search Strategy

Search strategies were developed for nine electronic databases: Medline (1950 to 11 April 2008), EMBASE (1980 to 11 April 2008), CINAHL (1982 to 11 April 2008), Ovid Healthstar (1966 to first week of February 2008), ABI/Inform (1918 to 11 April 2008), Dissertation Abstracts Online (1861 to 11 April 2008), Wilson Business Abstracts (1982 to 11 April 2008), NTIS (National Technical Information Service) (1964 to 11 April 2008) and the National Library of Medicine Meeting Abstracts (1950 to 11 April 2008). Database-specific search terms, including both medical subject-heading terms and keywords, were developed with the assistance of a medical librarian experienced in developing sensitive search strategies and using the indexed terms from known relevant articles and articles recovered from pilot searches. We reviewed the references of candidate articles retrieved in our primary searches and performed ancillary searches using the PubMed "see related articles" feature and the SciSearch Citation Index (*see* Appendix A in the online supplement).

Selection Criteria

A total of 5508 citations were reviewed. Studies were included if they described a population of prehospitalized or in-hospital critically ill adult patients (defined as [*A*] patients admitted to a medical-surgical intensive care unit or [*B*] patients receiving ventilator support, or inotropic or vasopressor medication, or experiencing acute respiratory distress syndrome or respiratory failure, shock or severe sepsis, or patients who were critically ill or experiencing trauma with a high injury severity score and located in other areas of a hospital; *and* [*C*] at least 50% of patients of the cohort must have been considered critically ill, *or* data from the critically ill patients could be abstracted from the primary paper [*see* Appendix B in the online supplement]). Using pilot-tested and refined abstraction instruments, two reviewers independently screened abstracts and identified 255 studies for full review. From these studies, 190 papers were further excluded on the basis of the inclusion and exclusion criteria. The remaining 65 articles were independently screened in duplicate by five teams of two reviewers using previously piloted eligibility forms. Disputes were resolved by discussion between reviewers until a consensus was reached. Twenty-nine articles were ultimately selected for inclusion in this study (Figure 1).

As there is no standardized quality scoring system for observational studies, reviewers assigned scores for each component of quality: adequacy of case mix or matching among groups and adjustment for confounders; evidence of sufficient power to detect differences; ascertainment of exposure and outcome; attempts at blinding; satisfactory duration of follow-up; and generalizability of the patient population (Table 1; *see also* Appendix C in the online supplement). Abstracted data included: patient population; dates of data collection; number of patients; insurance states; point estimates of association and measurements of statistical significance; number of patients experiencing outcomes broken down by insurance status; and potential confounders for which adjustments were made in the analysis. We contacted the corresponding study author when we required additional data or clarification of published data.

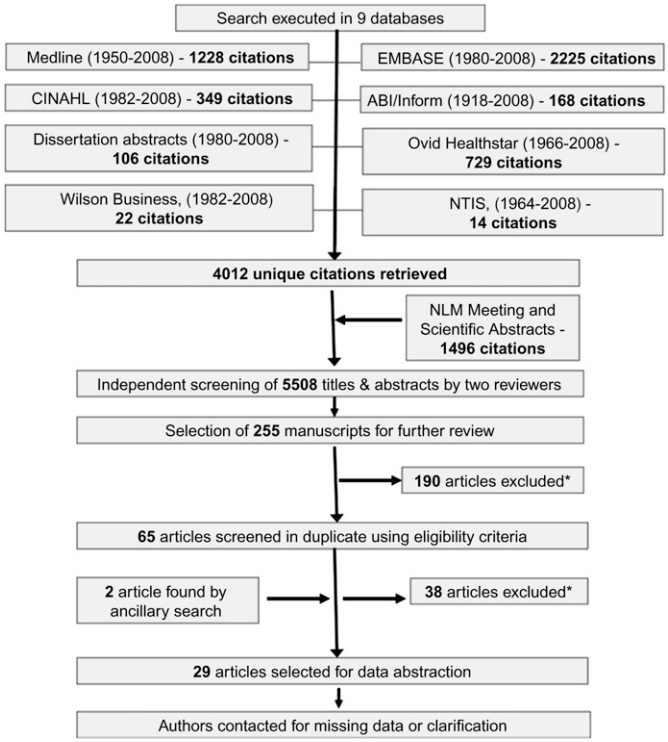

Figure 1. Study selection. *Reasons for exclusion: no comparator groups (n = 18); patients not critically ill (n = 11); study design not eligible (n = 3); outcomes of interest not reported (n = 4); duplicate data from other included study (n = 2); not adult patients (n = 1).

Data Synthesis

Studies were stratified and examined by health insurance status comparisons, either insurance versus no insurance or, within the insured group, managed care versus nonmanaged care. When comparing groups with insurance versus no insurance, we attempted to collapse results within each study from patients who had private/commercial insurance, private/commercial managed-care insurance, and other government insurance into a single insured category. The uninsured category was composed of patients who did not have insurance or were classified as self-pay or charity. In those studies for which we could not obtain enough information to collapse different insurance types, we only compared private/commercial insurance to no insurance. We explored how various degrees of insurance coverage may affect clinical outcomes in sensitivity analyses, comparing patients without insurance to those with private/commercial insurance, and separately, those with no insurance, charity, self-pay, or Medicaid to those with private/commercial insurance (*see* Appendix D of the online supplement). Patients with Medicare were excluded from the insured category because nearly all U.S. citizens age 65 years or over are Medicare-eligible, precluding comparisons not confounded by age and comorbidities; therefore, this group of patients was considered only in the comparisons of managed Medicare to nonmanaged Medicare. Managed care included patients enrolled in a private health maintenance organization (HMO), a preferred provider organization (PPO), or a Medicare managed care plan. In the category of nonmanaged care, we included patients who had traditional private insurance and traditional Medicare, where appropriate.

TABLE 1. RECEIPT OF THERAPEUTIC INTERVENTIONS FOR THE UNINSURED VERSUS INSURED CRITICALLY ILL PATIENTS

Outcome Measurement	OR (95% CI)	*P* Value	Adjustment for Potential Confounding	Reference
Use of ambulance to access emergency and critical care services	0.47 (0.23–0.98)	0.041	None	21
	0.85 (0.53, 1.36)	0.490	None	28
Withdrawal of mechanical ventilation	1.12 (0.81–1.56)*	0.484	None	30
Withdrawal of life support	2.80 (1.12–7.02)*	0.025	None	33
Discharge delay	4.51 (1.46–13.93)*	0.005	None	25
Physical therapy	0.66 (0.40–1.08)	0.097	Age, sex, race, ICU admission, orthopedic diagnosis, discharge disposition	24
Occupational therapy	0.55 (0.28–1.07)	0.079		24
Speech therapy	0.94 (0.51–1.73)	0.842		24
Receipt of pulmonary artery catheterization	0.75 (0.62, 0.91)*	0.004	Adjustment for patient, diagnostic and ICU organizational characteristics	37
Outcome Measurement	**Difference (95% CI)**	***P* Value**	**Adjustment for Potential Confounding**	
Admission-to-tracheostomy timing (days)	0.48 (–2.95, 1.98)	0.70	Age, sex, race, diagnoses, insurance state, discharge disposition	11
Number of procedures received (% difference)	8.5% (6.0–11.1)	<0.001	Age, sex, race, zip code, hospital teaching status, hospital ownership status, annual hospital discharges, principal diagnosis	39
Bedside nursing time (difference of means)	−6.1 min	0.17	None	41

* Calculated from original data presented in publication.
CI = confidence interval; ICU = intensive care unit; OR = odds ratio.

Statistical Analysis

The outcomes for the insured versus uninsured groups were admission rate to the intensive care unit (ICU) and hospital mortality. The outcomes for managed versus nonmanaged care were length of stay in the ICU and hospital and hospital mortality. The outcomes for these comparisons differ due to reporting differences in the primary studies. We present both unadjusted and adjusted odds ratios for binary outcomes (e.g., mortality or admission to ICU) whenever possible. Variables included in adjusted analyses are listed in Appendix E of the online supplement. For length of stay data, information on the measure of variation corresponding to the reported measure of central tendency for the raw numbers was not available for many of the studies, even after contacting authors. Therefore, we summarized the results based on the adjusted mean differences for ICU and hospital length of stay obtained from the available studies.

In comparisons of patients who were insured versus uninsured, we combined the adjusted odds ratios (ORs) for each of the binary outcomes (mortality and ICU admission). Within each study, a summary logarithm of the OR for uninsured versus insured was obtained by calculating a weighted average of log-ORs for uninsured versus each type of insurance. Individual log-ORs were weighted by the inverse of their variance; the standard error of the summary log-ORs was calculated assuming a correlation of 0.5 between each pair of individual log-ORs. To test the robustness of this assumption, we did sensitivity analyses with correlations of 0, 0.3, and 0.7 and found that our results did not change appreciably.

For the length of stay outcome, the regression coefficients were reported when the outcome was either on the original or log-transformed scale. For the log-transformed length of stay we interpreted the regression coefficients as relative differences in length of stay and derived the mean differences and their corresponding standard errors. For one study the author provided us with original data and we used the same models developed in their study to obtain estimates for the specific variables analyzed in this review (11). For a second study that examined mortality, we adjusted the reported OR for age, by

TABLE 2. RECEIPT OF THERAPEUTIC INTERVENTIONS FOR CRITICALLY ILL PATIENTS IN MANAGED VERSUS NONMANAGED CARE SYSTEMS

Outcome Measurement	OR (95% CI)	*P* Value	Adjustment for Potential Confounding	Reference
Receipt of pulmonary artery catheterization	0.53 (0.40–0.70)*	<0.001	None	37
Withdrawal of mechanical ventilation	1.31 (0.92, 1.86)	0.140	None	30
Potentially ineffective care	0.75 (0.65–0.87)	<0.001	Number of residents, number of beds, injury severity score	26
Outcome Measurement	**Difference (95% CI)**	***P* Value**	**Adjustment for Potential Confounding**	
Admission-to-tracheostomy timing (days)	−0.76 (–2.92 to 1.39)	0.48	Age, sex, race, diagnoses, insurance state, discharge disposition	11
Number of Procedures received (% difference)	14.3% (11.5–17.2)	<0.001	Age, sex, race, zip code, hospital teaching status, hospital ownership status, annual hospital discharges, principal diagnosis	39

Definition of abbreviations: CI = confidence interval; OR = odds ratio.
* Calculated from original data.

combining the log-ORs for different age groups weighted by the inverse of their variance (12). For a third study that compared hospital mortality for managed care to nonmanaged care, we based our estimate of the log-OR on adjusted proportions derived from the survival curves for the two groups (13).

We used Cochran's Q statistic test to assess possible heterogeneity between the individual studies (14), as well as the I^2 measure, which describes the percentage of variation across studies due to heterogeneity rather than chance (15, 16). Meta-analyses of ORs and regression coefficients were performed using an inverse variance weighting method with random-effects modeling that incorporates both between-study and within-study variation and generally provides a more conservative estimate of the treatment effect by taking into account statistical heterogeneity (RevMan 4.2.8; Cochrane Collaboration, Oxford, UK) (17). Delivery and receipt of care outcomes (Tables 1 and 2) were too heterogeneous to be combined using meta-analytic techniques. Therefore, we described these results qualitatively.

RESULTS

Study Search and Selection

We identified 28 published (12, 13, 18–43) and one unpublished (11) observational studies. Eighteen were cohort studies that examined the differences between the uninsured and insured (11, 12, 18–22, 24, 25, 28, 30, 31, 33, 37, 38, 41–43). Eight studies compared managed care programs to traditional insurance (11, 13, 23, 26, 30, 32, 36, 39). Four were before-and-after studies examining trends after the U.S. Medicare program's 1984 switch to a prospective payment system for hospital reimbursement (27, 29, 35, 40). One study reported the differences before and after the implementation of national health insurance (34). All but two studies focused entirely upon health care systems in the United States (28, 34) and our results focus upon data from the U.S. perspective.

The Association between Insurance and Care for Patients Who Are Critically Ill

Access to critical care services. Among the general population, the uninsured were much less likely than those who had insurance to receive critical care services (OR, 0.56; 95% confidence interval [CI], 0.55–0.56) (12). This association was consistent across age, sex, ethnicity, and reason for admission. However, once hospitalized, the uninsured may have been more likely than those with insurance to be admitted to an ICU (unadjusted OR, 1.61; 95% CI, 1.14–2.27; adjusted OR, 1.24; 95% CI, 0.94–1.65), but this increase was not statistically significant (Figure 2). Among patients who were critically ill and traumatically injured, the uninsured were also less likely than those with insurance to be admitted to a hospital (adjusted OR 0.63; 95% CI, 0.62–0.65) (42). Although there were no significant differences in the time it took patients to arrive at the emergency department (38), in one study, patients who were uninsured and critically ill were less likely to use an ambulance to get to the hospital than those who had insurance (OR, 0.47; 95% CI, 0.23–0.98) (21). In a second study that was better able to adjust for potential confounding by demographics and severity of illness at presentation, differences were not significant (OR, 0.85 95% CI, 0.53–1.36) (Table 1) (28).

Care delivery in ICU. Compared with patients who had insurance, those who were uninsured and critically ill were more likely to have life support withdrawn (OR, 2.80; 95% CI, 1.12–7.02) (33), less likely to have an invasive procedure (relative risk 0.92; 95% CI, 0.89–0.94) (39), or pulmonary artery catheterization (OR, 0.75; 95% CI, 0.62–0.91) (37) and more likely to experience discharge delays when medically ready to

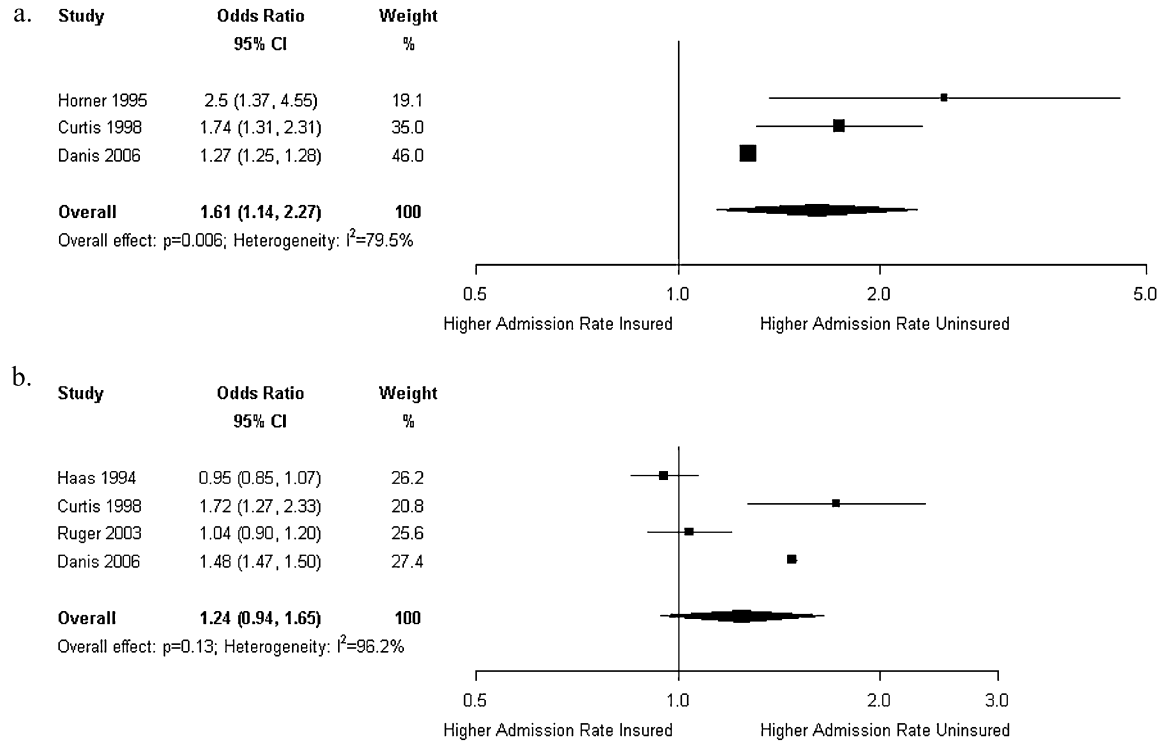

Figure 2. Admission rate to intensive care unit (ICU) for uninsured versus insured patients presenting to hospital. (*a*) Unadjusted rates of admission to ICU. (*b*) Adjusted rates of admission to ICU.

leave the hospital (OR, 4.51; 95% CI, 1.46–13.93) (25). Although not statistically significant, patients who were uninsured tended to have mechanical ventilation withdrawn more frequently (OR, 1.12; 95% CI, 0.81–1.56) (30), and received less physical therapy (OR, 0.66; 95% CI, 0.40–1.08) and occupational therapy (OR, 0.55; 95% CI, 0.28–1.07) than insured patients (24).

Clinical outcomes. Five studies reported hospital mortality in relation to insurance status (12, 18, 20, 31, 39, 43), but one of these did not adjust for potential confounders (18). Among studies that adjusted for potential confounding variables, patients who were critically ill and without health insurance had a higher hospital mortality (OR, 1.16; 95% CI 1.01–1.33) (12, 18, 31, 39, 43) (Figure 3). In sensitivity analyses, we found that patients without insurance had a higher independent risk of death when compared with those with private/commercial insurance (OR, 1.25; 95% CI, 1.02–1.53) (Figure 1, Appendix D) and that patients with insurance only through Medicaid had an attenuated risk that was no longer significantly different (OR, 1.18; 95% CI 0.87–1.60) from those with other forms of insurance (Figure 2, Appendix D).

The Association between Managed Care Systems and Care for Patients Who Are Critically Ill

Access to and delivery of critical care. No study addressed access to critical care services under a managed care system. However, patients who were critically ill in a managed care (compared with nonmanaged care) system received 14.3% (95% CI, 11.5–17.2) fewer procedures (39), including pulmonary artery catheterization (OR, 0.53; 95% CI, 0.40–0.70) (37). There was no statistically significant difference in withdrawal of mechanical ventilation (30). Patients in managed care were less likely to receive "potentially ineffective care," defined as the highest quartile of costs divided by mortality at 100 days (OR, 0.75; 95% CI, 0.65–0.87) (26) (Table 2).

Clinical outcomes for patients who are critically ill. Five analyses found similar ICU (11, 23, 32, 36) and hospital (11, 36, 39) lengths of stay for patients in managed care and nonmanaged care systems, after adjustment for potential confounding factors (Figure 4). Four studies (13, 23, 36, 39) found that managed care was associated with lower unadjusted hospital mortality (OR, 0.64; 95% CI, 0.48–0.85) (Figure 5a), but this difference was of borderline statistical significance (OR 0.80; 95% CI, 0.64–1.00) (Figure 5b) in the studies that reported mortality adjusted for potential confounders (13, 23, 26, 39).

Prospective Payment System versus Fee-for-Service Hospital Reimbursement

After the implementation of the prospective payment system in U.S. Medicare in 1983, there was no evidence of a change in the proportion of patients admitted to ICU in two studies (27, 40), and no significant change in the ratio of observed to predicted hospital mortality in another study (ratio 1.05; $P > 0.05$) (35).

The Association between National Health Insurance and Care for Patients Who Are Critically Ill

Only one study, conducted in Taiwan, examined ICU use before and after the introduction of national health insurance. This study found similar overall use of ICU resources and no difference in the number of interhospital transfers of patients receiving ICU care between the two periods (34).

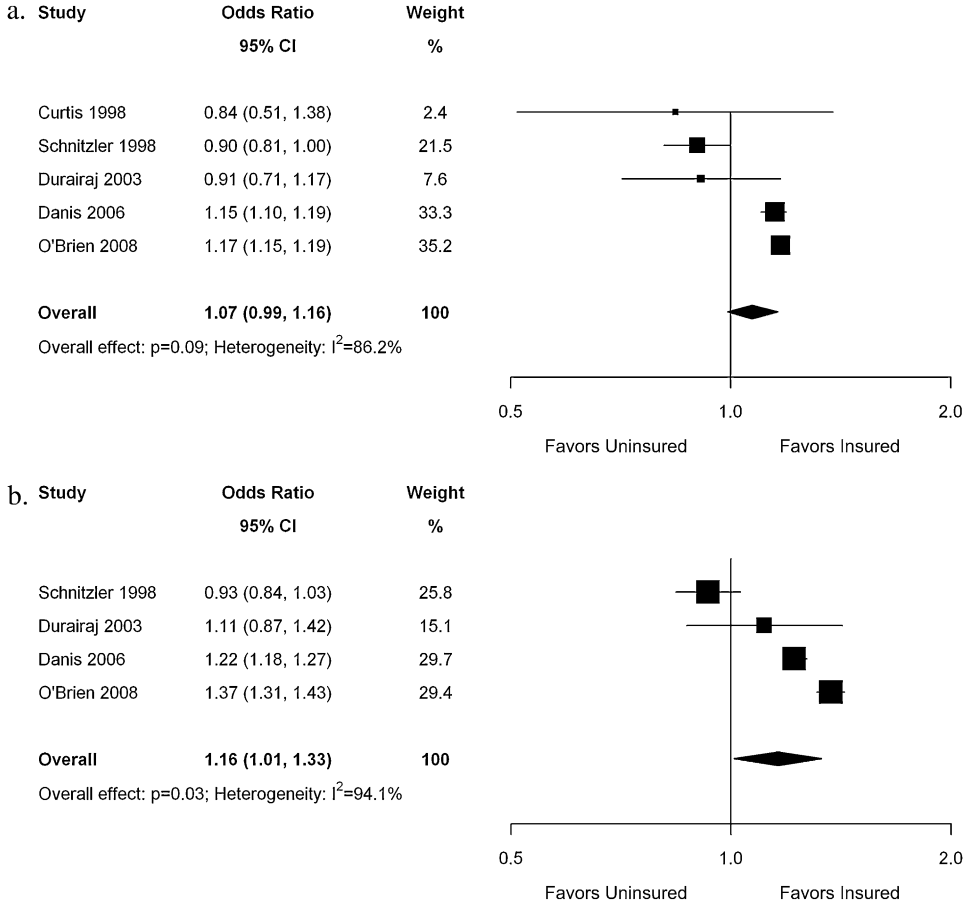

Figure 3. Hospital mortality rates for uninsured versus insured critically ill patients. (*a*) Unadjusted mortality rates. (*b*) Adjusted mortality rates.

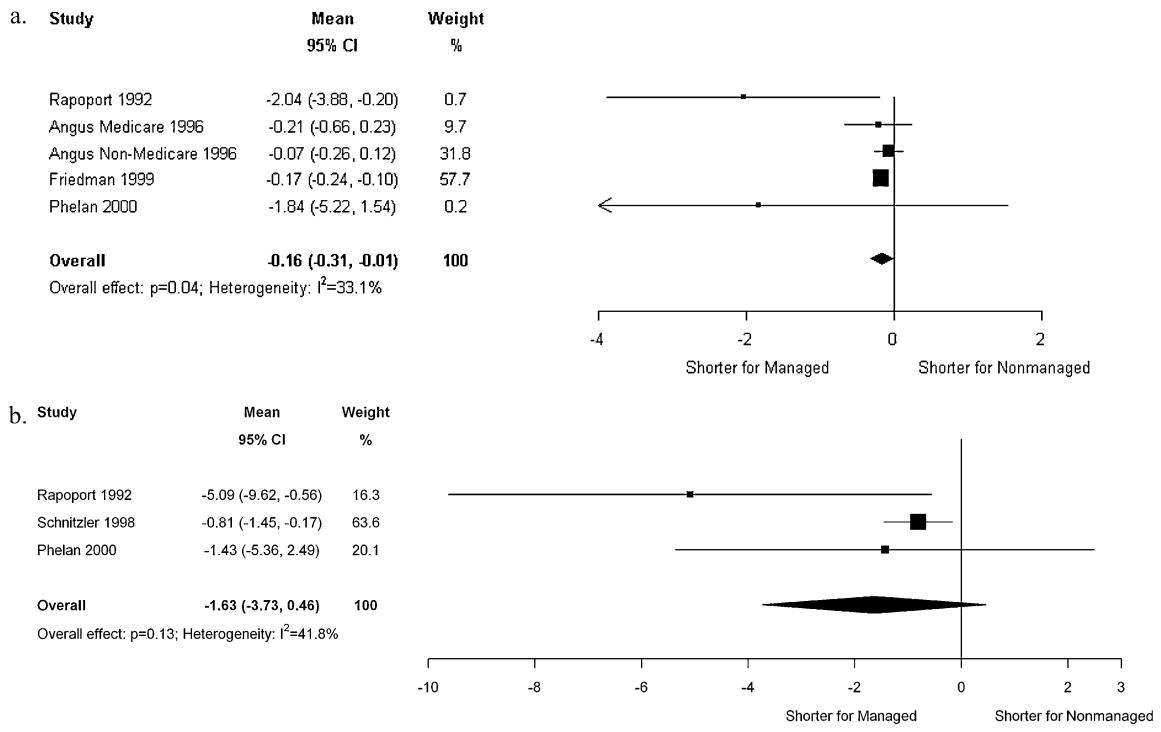

Figure 4. Intensive care unit (ICU) length of stay for patients who are critically ill with managed versus nonmanaged care. (*a*) Adjusted ICU length of stay (days). (*b*) Adjusted hospital length of stay (days).

DISCUSSION

We reviewed medical and nonmedical literature from a wide range of databases to determine whether health insurance or payer status is associated with access to care, care delivery, and outcomes of critical illness. We found that among the general population, the uninsured appear less likely to receive critical care services, but may be more likely to be admitted to an ICU after hospitalization. Once admitted to the ICU, patients who are uninsured are less likely to receive certain life-supporting procedures, more likely to have life support withdrawn, and possibly more likely to die. We found that patients who receive

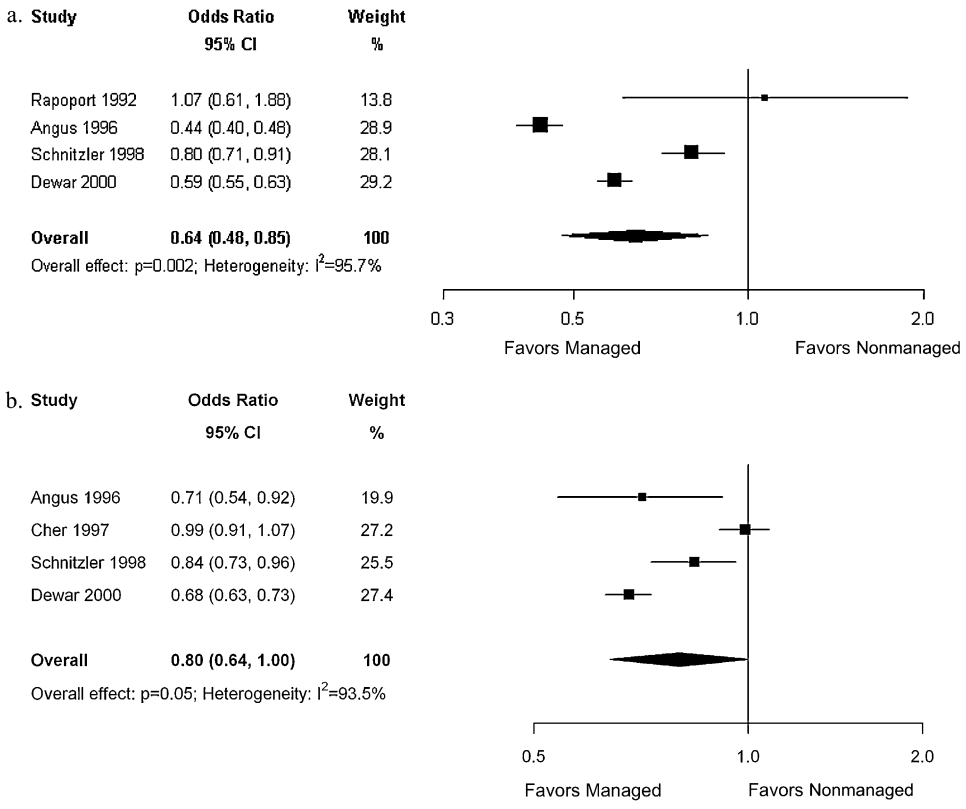

Figure 5. Hospital mortality rates for patients who are critically ill with managed versus nonmanaged care. (*a*) Unadjusted mortality rates. (*b*) Adjusted mortality rates.

managed care are less likely to receive specific procedures, but also less likely to receive "potentially ineffective" care. Our results suggest that insurance status influences care received by patients who are critically ill, a population at particular risk because of the high cost of treatment and potentially immediate impact of suboptimal care on morbidity and mortality.

Our review is the first systematic search for evidence of insurance-related disparities in care for patients who are critically ill. Our findings are comparable to patients who are uninsured and who have acute coronary syndromes and who are more likely to present late to the emergency room, which is associated with the need for more resource-intensive care and worse outcomes (44). Similarly, patients who are uninsured and have breast or colorectal cancer are less likely to receive treatment at early stages of disease (45–47). Our finding that the uninsured are less likely to receive critical care overall could relate to patient or provider decisions not to undergo or offer certain scheduled therapies or procedures that may require ICU care. The finding that the uninsured were more likely to be admitted to the ICU after arriving at a hospital, could occur if the uninsured delayed going to a hospital until experiencing a more advanced stage of illness. That the uninsured were perhaps less likely to use an ambulance to get to the hospital provides some support for this concept. Unfortunately, differences among studies do not allow us to confirm such hypotheses. Although not the focus of this review, other literature has described inappropriate interhospital transfers based on the insurance status of patients who are acutely (48). Although U.S. hospitals are legally obligated to care for all patients who are emergently ill, they are not obligated to be the continuing provider for medically stabilized uninsured patients. We found that patients who are critically ill and uninsured were more likely to experience discharge delay, particularly due to difficulty in finding healthcare providers or facilities to accept care for these patients (25). Although heterogeneity of studies precluded quantitative combination of various measures of receipt of care for critically ill patients, our review suggests that uninsured patients receive fewer procedures and services than the insured, a phenomenon that is also described in cardiac care (49).

Our review suggests that lack of any insurance may also confer an independently increased risk of death for patients who are critically ill. Despite the clinical and statistical heterogeneity inherent in these studies of differing designs, durations, and populations, three-quarters of studies that adjusted for potential confounders found increased estimates of mortality among the critically ill without insurance. Sensitivity analyses also suggest a gradient of effect size: those with commercial or private insurance may have the lowest risk of death compared with patients who self-pay; the addition of Medicaid for those without other forms of coverage reduces this risk.

Our review suggests that some components of managed care may be a cost-effective alternative to traditional health insurance for patients who are critically ill. We found evidence for a reduction in "potentially ineffective" care for patients who are critically ill, with similar length of stay and mortality, analogous to the managed care literature related to patients who have stroke or myocardial infarction (50, 51). However, there is substantial heterogeneity among managed care plans. Within Medicare, only a small proportion of patients with managed care have been evaluated, and our ability to draw firm conclusions is limited. Managed care has been proposed as a mechanism to provide patients with appropriate medical treatment and services while providing an oversight structure to limit services deemed unnecessary (52–54). If managed care functions optimally for patients and providers, it insures timely receipt of needed services in a cost-efficient manner. However, it is difficult to prospectively determine appropriate care for patients who are acutely ill. Even the most timely prospective review of proposed care for critically ill patients may contribute to unanticipated consequences due to a potentially harmful delay (55).

Issues about decreased resource use and the impact on access, delivery, and patient outcomes are also important to consider when evaluating the impact of Medicare's change to prospective payment system. Under this system hospitals are reimbursed based on the patient's diagnosis related group (DRG), which may motivate hospitals to limit certain aspects of more expensive care. Alternatively, this system may create an incentive for hospitals to provide services that enable upcoding to a more lucrative DRG, such as tracheostomy for patients who have acute respiratory failure. In effect, this shifts a portion of the oversight responsibility from the insurance provider or payer to the hospital. We found that case-based reimbursement may attenuate costs, and the implementation of a prospective payment system has not been associated with dramatically changed population patterns of ICU use (27, 29, 40) or hospital mortality for the critically ill (35).

There are very limited data regarding the impact of a transition to a national health insurance system for all patients on the care of those who are critically ill. Only one study met our eligibility criteria, and it found that over a limited duration there was no change in access to ICU resources for patients. Implementation of a national insurance system might influence access and receipt of care for patients in unpredictable ways in different jurisdictions that have different baseline mechanisms of funding; this is an area in need of further research (56, 57).

Our review has several limitations. First, our dataset was composed of observational studies, which are generally more subject to bias when compared with randomized controlled trials (58). However, we found no eligible randomized trials in our literature search, and it is unlikely that randomized trials of insurance status will be forthcoming. In addition, studies varied in the adjustment for potential confounders. However, two authors undertook a structured assessment of bias and quality for each study, including an adjustment for important potential confounders. We reported both unadjusted and adjusted point estimates whenever available. Second, all potential confounders regarding admission patterns, care delivery, and outcomes were not included in every study. We attempted to minimize this bias by not considering case series, reviews, or other designs without a clear comparison of at least two insurance states. The influence of hospital case-mix on potential disparities was not described in many studies, and the magnitude of disparity may differ between institutions with high and low levels of patients who are uninsured. For example, such hospital-level variables and regional differences in end-of-life care can have important effects on outcomes, but due to the heterogeneity of the datasets used, these cannot be fully explored (59–61). We chose to limit comparisons of U.S. Medicare with other forms of insurance because of the inability to compare these patient populations with systematically different ages and comorbidities; hence, our conclusions involving Medicare are limited to comparing managed and nonmanaged care. Third, we were unable to investigate for publication bias given the few available studies. However, we undertook extensive searches of published and unpublished work. Finally, although we focused our review upon the care of the "critically ill," our findings represent heterogeneous study questions, patient populations, individual insurance, and payer states. Such heterogeneity limited our ability to combine point estimates of effect to specific outcomes from some studies. There is heterogeneity even among the uninsured. Some are uninsured by choice, some due to poverty, and conceivably, some due to affluence. However, the latter

possibility is undoubtedly very uncommon and would not likely affect our results. We attempted to decrease heterogeneity in the comparison groups by obtaining raw data from authors when possible, and used a random effects model to minimize overestimation of effect sizes. However, due to the limitations of observational design and heterogeneity of included studies, our point estimates must be interpreted with caution, cannot infer causality of insurance or payer state and outcome, and represent a summary of the existing literature.

In summary, we found evidence that patients who are critically ill with lesser degrees of insurance coverage receive fewer critical care services compared with those who have more insurance. Developing more comprehensive programs and legislation to improve health coverage for patients who are acutely ill would therefore seem a logical avenue for investigation. However, any such programs will have an associated cost, which could be substantial as the costs of critical care approach 1% of the U.S. gross domestic product, and one-third of the population under the age of 65 is uninsured for a portion of any given year. However, such costs are already being borne by society at large. The provision of insurance coverage to the uninsured also raises concern about surges in unnecessary and costly healthcare consumption. Increased opportunity to receive care not associated with improved outcomes (for example, clinically unnecessary diagnostic procedures or prolonged use of ventilation without an expectation of improved long-term outcome) is not likely to improve the care of the critically ill. However, recent evidence shows that individuals who move from no insurance to more comprehensive coverage do not use more resources than the consistently and long-term insured (62). Additionally, patients who are uninsured tend to incur large costs, and the unpaid charges, which often fall to the healthcare institution or state, contribute sizably to governmental healthcare spending and the adjusted cost-to-charge ratios for all patients. Our findings indicate there may be a role for certain components of managed care or diagnosis related grouping reimbursement programs in providing cost-effective care, but such a system must ensure that timely access to care deemed appropriate is not sacrificed. As we struggle to improve mechanisms of providing equitable care to the population, our review indicates that there may be inequities in the provision of care to a vulnerable segment, that is, those who are very sick and in need of care but who cannot afford care. Even with increased access to health insurance, other factors such as low education level, limited social support, and homelessness will continue to conspire against equitable care. As a society, we should urgently explore options to reduce such disparities across the population and particularly for those most vulnerable and those most in need.

This statement was prepared by an *ad hoc* subcommittee of the Behavioral Science Assembly.

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