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Is Sepsis Accurately Coded on Hospital Bills?

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ABSTRACT

Objective: To examine whether sepsis is accurately coded on hospital bills.
Methods: Hospital inpatient uniform bills (UB-92) for 122 patients with clinically documented severe sepsis of presumed infectious origin were retrospectively examined. Final UB-92 hospital bills were obtained for all study subjects. ICD-9-CM diagnosis codes from these bills were then reviewed to ascertain the number of subjects for whom one or more diagnostic codes for septicemia and/or bacteremia were present.
Results: A total of 92 hospital bills (75.4%) contained one or more ICD-9-CM diagnostic codes for septicemia and/or bacteremia. Of the 30 that did not, 15 (12.3%) had codes for major systemic infection and organ failure. No diagnoses indicative of sepsis (i.e., organ failure and major infection) were present on the remaining 15 (12.3%) bills.
Conclusions: Our findings suggest that use of ICD-9-CM codes for identifying patients with sepsis using hospital bills is only moderately sensitive. Strict reliance on administrative data sources for sepsis surveillance or research planning may therefore be prone to substantial error.
Keywords: database management systems, epidemiology, septicemia.

Introduction

Sepsis is a pervasive and costly disease among hospitalized patients in the United States. It is a major cause of death among the elderly and the leading cause of death among patients in noncoronary intensive care units (ICUs) [1]. Estimates of the incidence of sepsis vary widely, ranging from 10 to 175 per 1000 hospital admissions [2–5]. Comparisons of incidence estimates from observational studies are made difficult by differences in study design, entry criteria, and research settings. The most frequently cited incidence estimates in the United States are derived from administrative datasets [6,7].

Administrative datasets are increasingly being used for a variety of purposes, including disease surveillance, postmarketing evaluation of new pharmaceuticals, and assessment of clinician performance. While these datasets are readily accessible and relatively inexpensive, diagnostic information contained therein is known to be less than completely accurate. For example, the sensitivity of coded diagnoses from health-care claims data has been reported to be below 80% overall, ranging from 58% for peripheral vascular disease to over 90% for several types of cancer [8,9]. Sensitivity for selected complications of diabetes alone ranges from 73% to 95% [10]. Reliance solely on administrative data for the above-mentioned purposes may therefore be subject to substantial misclassification.

To explore whether coding accuracy is an issue in sepsis, we undertook an examination of hospital bills among patients with clinically documented disease, using a convenience sample from a clinical trial for severe sepsis.

Methods

We reviewed the ICD-9-CM diagnosis codes on the hospital bills of patients with clinically documented severe sepsis of presumed infectious origin to ascertain the frequency with which codes for septicemia and/or bacteremia were present. The study sample consisted of 122 hospitalized patients from 10

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medical centers who were participating in a clinical trial for severe sepsis of presumed infectious origin.

In this trial, severe sepsis was defined by the simultaneous presence of five clinical criteria, as follows:

1. isolated organism(s) from one or more positive cultures within 72 hours of study entry or clinical diagnosis of an organ abscess or suppurative inflammation;
2. hyperthermia (core temperature ≥38.0°C) or hypothermia (≤35.6°C);
3. tachycardia (≥90 beats/min) in the absence of beta blockade or cardiac pacemaker;
4. tachypnea (≥20 breaths/min) or mechanical ventilation;
5. hypotension (systolic blood pressure ≤90 mmHg, decrease in systolic blood pressure of ≥40 mmHg, or use of vasopressors), evidence of systemic toxicity, or poor end organ perfusion.

These criteria are similar to those proposed for distinguishing severe sepsis from sepsis and systemic inflammatory response syndrome (SIRS) by a consensus conference of the American College of Chest Physicians and the Society for Critical Care Medicine [11].

A final hospital bill, in uniform bill (UB-92) format, was also obtained for each patient in the sample; informed consent for financial information was obtained for each study subject prior to enrollment in the trial. Up to nine diagnoses (in ICD-9-CM format) were included on each bill. These diagnoses were then reviewed to determine the frequency with which septicemia and/or bacteremia was coded in the study sample. Diagnosis codes of interest are presented in Table 1; codes for pregnancy-related or neonatal sepsis were excluded to match the profile of patients participating in the trial.

Table 1 Diagnosis codes for sepsis

ICD-9-CM Code	Description
038.3	Anaerobic septicemia
022.3	Anthrax septicemia
790.7	Bacteremia NOS
038.42	*E. coli* septicemia
038.49	Gram-negative septicemia NEC
038.40	Gram-negative septicemia NOS
038.41	*H. influenzae* septicemia
054.5	Herpetic septicemia
036.2	Meningococcemia
038.2	Pneumococcal septicemia
038.43	Pseudomonas septicemia
003.1	Salmonella septicemia
038.8	Septicemia NEC
038.9	Septicemia NOS
020.2	Septicemic plague
038.44	Serratia septicemia
038.1	Staphylococcal septicemia
038.0	Streptococcal septicemia

Abbreviations: NEC, not elsewhere classified; NOS: not otherwise specified.

Results

Of the 122 UB-92 hospital bills in the study sample, 92 (75.4%) contained one or more ICD-9-CM codes for septicemia and/or bacteremia. The distribution of these codes is presented in Table 2. Among the remaining 30 bills, 15 (12.3%) included codes for major systemic infection (e.g., disseminated candidiasis) and organ failure (e.g., acidosis, acute renal failure, secondary thrombocytopenia). Codes for respiratory infection were most common in this group (7/15 = 46.7%); codes for respiratory and/or renal failure were present on all 15 of these bills. Fifteen bills had neither codes for sepsis nor codes for major infection and organ failure. Four of these had codes for major infection only, while nine had codes for organ failure only. Two bills did not have any codes that indicated the presence of sepsis.

Discussion

To ascertain whether sepsis is accurately coded on the hospital bills of patients with clinically documented disease, we examined ICD-9-CM diagnosis codes on the UB-92 bills of 122 patients with severe sepsis who were participating in a clinical trial.

Our findings indicate that use of ICD-9-CM codes for identifying patients with sepsis is only moderately sensitive and may miss up to one-quarter of patients with this disease. Clearly, the clinical definition of severe sepsis (evidence of systemic inflammatory response, major infection, and organ failure [11]) has progressed beyond what can

Table 2 Distribution of sepsis diagnoses among patients with one or more sepsis codes (N = 92)

ICD-9-CM Code	Description	n (%)
038.1	Staphylococcal septicemia	32 (34.8)
038.9	Septicemia NOS	19 (20.7)
038.0	Streptococcal septicemia	13 (14.1)
038.2	Pneumococcal septicemia	9 (9.8)
038.49	Gram-negative septicemia NEC	8 (8.7)
038.42	*E. coli* septicemia	7 (7.6)
038.8	Septicemia NEC	5 (5.4)
—	Other	9 (9.8)

Note: More than one sepsis code could appear on each bill; percentages may not sum to 100.
Abbreviations: NEC, not elsewhere classified; NOS: not otherwise specified.

be captured in a single diagnosis of septicemia or bacteremia. However, even after we included combinations of ICD-9-CM diagnosis codes that would likely indicate sepsis, over 10% of patients had codes that provided no evidence that sepsis was present.

The following important limitations of our analysis should be noted. First, complete study of the accuracy of disease classification methods requires ascertainment of their sensitivity and specificity. Calculation of the latter was not possible in our study because the study sample included only patients with clinically confirmed severe sepsis; accordingly, a false-positive rate could not be calculated. While our expansion of the ICD-9-CM-based definition resulted in improved sensitivity, its effect on specificity was unknown.

In addition, hospital information systems typically include 15 to 20 diagnosis codes for each admission, while the UB-92 format allows for only 9 codes. It is therefore possible that, for some patients, sepsis was coded on the medical record but not on the hospital bill. We believe that this accounts for a relatively small percentage of cases, however, because sepsis is considered a modifying diagnosis (i.e., one that may increase payment under Medicare's Prospective Payment System) and is therefore likely to appear on most hospital bills.

Conclusions

Strict reliance on administrative data sources for sepsis surveillance or research planning may be prone to substantial error. Health-service researchers should therefore exercise caution when employing estimates of disease incidence that are based on administrative data. Steps should also be taken to ensure that current standards for defining sepsis are adhered to and that coding practices are revised accordingly.

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