



Impact of older age and nursing home residence on clinical outcomes of US emergency department visits for severe sepsis[☆]

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Abstract

Purpose: The purpose of this study is to compare the impact of older age and nursing home residence on the incidence and morbidity of severe sepsis.

Materials and Methods: This was a retrospective analysis of 19460 emergency department visits from the 2005 to 2009 National Ambulatory Medical Care Surveys with diagnosis of infection with or without severe sepsis (acute organ dysfunction). Clinical outcomes included intensive care unit (ICU) admission, hospital length of stay (LOS), and in-hospital mortality.

Results: Older adults (age ≥ 65 years) were 5-fold more likely to have infections classified as severe sepsis than younger adults (6.5% vs 1.3%), and nursing home residents were 7-fold more likely to have a severe sepsis diagnosis compared with nonnursing home residents (14% vs 1.9%). Among visits for severe sepsis, older adults, compared with younger adults, had modestly higher rates of ICU admission (27% vs 21%), hospital LOS (median, 6 vs 5 days), and in-hospital mortality (24% vs 16%). Nursing home residents with severe sepsis, compared with nonnursing home residents, had significantly higher rates of ICU admission (40% vs 21%), hospital LOS (median, 7 vs 5 days), and in-hospital mortality (37% vs 15%).

Conclusions: Older adults and particularly nursing home residents have a disproportionately high incidence of and morbidity from severe sepsis.

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1. Introduction

Severe sepsis is a syndrome of infection-related acute organ dysfunction that hospitalizes 750 000 annually, resulting in 215 000 deaths and an estimated \$16.7 billion in direct medical costs in the United States [1]. Although the incidence of severe sepsis increased 4-fold from 1979 to 2000, the mortality decreased from 27.8% to 17.9% [2]. Emphasis on early recognition and aggressive intervention for severe sepsis in emergency department (ED) and intensive care unit (ICU) patients has reduced associated morbidity [3,4]. However, severe sepsis remains the 10th leading cause of death in the United States and the leading cause of death in noncardiac ICUs, with 51% mortality at 1 year and 74% mortality at 5 years [5,6]. In addition, the rate of discharge to rehabilitation or long-term care facilities after hospitalizations for severe sepsis has markedly increased [2].

Older adults suffer the most of the severe sepsis burden in the United States, with a steep increase in incidence with advancing age [2,7-9]. In addition, the mortality from severe sepsis rises with increased age and frailty [1,2,5,7]. Prior national studies of outcomes using hospital discharge data have included a substantial proportion of hospital-acquired infections and severe sepsis. Recent efforts through the Surviving Sepsis campaigns aimed at early detection and treatment of severe sepsis patients presenting to the ED setting have successfully reduced morbidity [4]. National data on outcomes after ED visits for severe sepsis could help to inform future research efforts and treatment decisions, including anticipated prognosis. However, prior national ED-based studies of severe sepsis have lacked important data on hospital outcomes and nursing home residence before presentation, a potentially important risk stratification variable in addition to age [8,9].

In 2005, the National Hospital Ambulatory Medical Care Survey (NHAMCS) began to collect hospital outcome data and prior nursing home residence, providing the opportunity to reanalyze current national epidemiologic data on ED visits for severe sepsis. The primary objective of this study was to compare the impact of age older age (defined as age ≥ 65 years) or present nursing home residence on the incidence and morbidity of severe sepsis.

2. Materials and methods

2.1. Study design and participants

This study was a secondary analysis of adult (age, ≥ 18 years) ED visits in the 5 most recent years (2005-2009) of the NHAMCS database, a nationally representative survey of ED visits, conducted annually by the National Center for Health Statistics. We received a waiver from our institutional review board as an exempt study.

Details of survey methodology are described elsewhere [10]. Briefly, the NHAMCS is a 4-stage probability sample of visits to EDs associated with US noninstitutional, general, and short-stay hospitals. During 2005 to 2009, a sample of 2390 hospitals was selected for participation in NHAMCS. Of the 1968 hospitals deemed eligible based on type of hospital, 1768 (90%) participated, and a total of 174 020 ED visits were abstracted. Trained National Center for Health Statistics staff collected data during a randomly assigned 4-week data period for each of the sampled hospitals. When the data collection forms were completed, they were sent to the Constella Group (Durham, NC), where they were coded using the *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* [11]. The NHAMCS data provide ED diagnoses (at the time of discharge from the ED or hospital admission) and do not represent hospital discharge diagnoses for admitted patients. For visits resulting in hospital admission, hospital course was also tracked.

2.2. Identification of severe sepsis

We used standard consensus criteria to define severe sepsis as concurrent bacterial or fungal infection plus acute organ dysfunction [4,12]. To identify cases of severe sepsis, we used the *ICD-9-CM* for infection and acute organ dysfunction in any of the 3 recorded ED diagnosis fields. This case definition did not include visits by patients whose infection or acute organ dysfunction was recognized or developed after the ED visit (eg, during the hospitalization). The *ICD-9-CM* codes were based on previously validated methodology to define presence of a bacterial or fungal infection or acute organ dysfunction (Appendix Tables 1 and 2) [1,5]. These codes have been used in more recent epidemiological analyses of severe sepsis in administrative data sets [9,13]. We also considered endotracheal intubation performed during the ED visit or hypotension (ED triage systolic blood pressure < 90 mm Hg) to be markers of acute organ dysfunction, as previously reported [2]. Finally, we added the single *ICD-9-CM* code 995.92 (severe sepsis/sepsis with acute organ dysfunction/sepsis with multiple organ dysfunction) to the severe sepsis criteria.

2.3. Clinical characteristics

The primary characteristics of interest were age and residence at a nursing home immediately before the ED visit. Although we recognize that different age thresholds to define "older adults" may be used, we dichotomized age at 65 years to compare with prior inpatient data for our primary analysis [7]. Other demographic characteristics were analyzed including sex, race/ethnicity, US census region, and urban location. Emergency department clinical characteristics included ambulance arrival, initial ED triage vital signs, triage acuity (immediate/emergent, urgent, semiurgent/nonurgent), and site of infection

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