Improved Clinical Outcomes With Utilization of a Community-Acquired Pneumonia Guideline*

Nathan C. Dean, MD, FCCP; Kim A. Bateman, MD; Steven M. Donnelly, PhD; Michael P. Silver, MPH; Greg L. Snow, PhD; and David Hale, PharmD, MHA

Background: **We previously reported decreased mortality following implementation of a community-acquired pneumonia guideline derived from specialty society recommendations. However, patients with respiratory failure and sepsis from pneumonia were not included, adjustment for comorbidities was limited, and no guideline compliance data were available. We also questioned whether decreased mortality continued after 1997.**

Methods: **We utilized Utah data from the Centers for Medicare and Medicaid from 1993 to 2003 to determine if pneumonia guideline implementation was associated with 30-day all-cause mortality, length of hospital stay, and readmission rate. We adjusted outcomes by age, gender, Deyo comorbidity score, prior hospitalizations, and race. Guideline compliance was measured by initial default guideline antibiotic administration. We included patients ≥ 66 years old with primary International Classification of Diseases, Ninth Revision, Clinical Modification codes 480.0–483.9, 485.0–486.9, 487.0, 507.0 or 518.81, and 038.*x* with secondary code pneumonia. We excluded patients with prior hospitalization within 10 days, patients with HIV infection or transplant recipients, and patients not treated by physicians closely affiliated with study hospitals.**

Results: **Mean (± SD) age of 17,728 pneumonia patients admitted to the hospital was 72.3 ± 12.0 years, 55.2% were female, and 96.0% were white. Within Intermountain Healthcare hospitals, a 1-SD increase (10%) in guideline compliance (range, 61 to 100%) was associated with mortality odds ratio (OR) of 0.92 (95% confidence interval [CI], 0.87 to 0.98; p = 0.007). Mortality OR at 16 Intermountain Healthcare hospitals was 0.89 (95% CI, 0.82 to 0.97; p = 0.007) compared with 19 other Utah hospitals. This mortality difference corresponds to approximately 20 lives saved yearly. The readmission rate was also lower.**

Conclusion: **Improved clinical outcomes were associated with pneumonia guideline utilization.**

(CHEST 2006; 130:794–799)

Key words: mortality; patient admission; pneumonia; practice guidelines; therapy

Abbreviations: CI = confidence interval; CURB-65 = confusion, elevated blood urea nitrogen, elevated respiratory rate, low systolic or diastolic BP, and age > 65 years; ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification; OR = odds ratio

Community-acquired pneumonia leads to 1.7 million hospital admissions in the United States and is the most common cause of death from infection.[1,2] Mortality averages 13.6% among hospitalized patients and is even higher among the elderly.[3] Expert committees have published treatment guidelines[4–7] intended to improve the care of pneumonia patients. However, the guidelines were not prospectively validated, and whether guidelines improve clinical outcomes has been debated.[8–11] Expert guidelines are difficult to implement, and traditional continuing medical education has little effect on physician practice.[12–19]

Lower mortality has been observed with early administration of certain antibiotics[20–25] and may be reduced further by prophylaxis against deep venous thrombosis.[26,27] An implemented pneumonia guideline containing these elements might lower mortality. Two concurrently controlled studies[28,29] reported decreased mortality linked with a pneumonia treatment guideline; the first study was our prior study.[28] However, the International Classification of Dis-

eases, Ninth Revision, Clinical Modification (ICD-9-CM) codes used to define our earlier study population did not include severe cases primarily coded as respiratory failure (518.81) or sepsis (038.x) with secondary pneumonia codes. We previously used both part A (hospital inpatient) and part B (outpatient) data in order to include outpatients, but therefore could not adjust mortality risk by the Deyo comorbidity score[30] or by the number of prior hospitalizations. In addition, pneumonia guideline use could only be temporally associated with lower mortality, since we had minimal utilization data.

In this study, we wanted to overcome earlier limitations and also to study whether lower mortality compared with other Utah hospitals persisted beyond the first years of guideline use. We now compare mortality between Intermountain Healthcare hospitals with different levels of guideline utilization as measured by initial antibiotic administration. In addition, guideline logic has evolved since the earlier study: oral doxycycline has replaced azithromycin for non-ICU patients, enoxaparin has replaced unfractionated heparin prophylaxis, early ambulation is emphasized, and the CURB-65 rule (confusion, elevated blood urea nitrogen, elevated respiratory rate, low systolic or diastolic BP, and age > 65 years)[31] is now used for admission-decision support. These and other changes in guideline logic made a new outcome study necessary.

Materials and Methods

A pneumonia guideline was introduced in Intermountain Healthcare hospitals and outpatient facilities between January 1995 and January 1998. We have reviewed the methods of guideline development and implementation.[11] Briefly, clinicians developed the guideline in conjunction with administrative and data support personnel by combining local practices with American Thoracic Society and Infectious Disease Society of America recommendations for treating community-acquired pneumonia. Guideline implementation included formal presentations, academic detailing, standardized outpatient and inpatient order sheets,[28] frequent reminders via several methods, and reporting of outcome data to providers. A committee that meets bimonthly keeps the pneumonia guideline logic simple, updated, and implemented. Key logic elements included currently are listed in Table 1.

Intermountain Healthcare is a not-for-profit integrated healthcare system that includes 16 general adult hospitals and > 90 outpatient clinics within the state of Utah. Facilities range from major adult tertiary care teaching/research hospitals to small hospital and clinics that are the only source of health care for their rural communities. The 100,000 annual inpatient admissions of Intermountain Healthcare represent almost one half of Utah hospital admissions. Intermountain Healthcare has an employed physician group and several non-Medicare health maintenance organization insurance plans, but many nonemployed physicians and non-health maintenance organization patients also utilize its facilities. Financial and administrative incentives encourage employed physicians to use the pneumonia guideline for yearly quality care projects. Approximately two thirds of pneumonia patients treated at Intermountain Healthcare hospitals are > 65 years of age. Other Utah hospitals included in this study are the University of Utah Health Sciences Center, six small community-owned facilities, six hospitals owned by MountainStar Healthcare, four hospitals owned by Iasis Healthcare, and two hospitals operated by LifePoint Hospitals.

Patient Inclusions and Exclusions

We used Medicare part A data, including only claims from Utah Hospitals from 1993 to 2003 for Utah resident Medicare beneficiaries aged ≥ 66 years with primary ICD-9-CM codes

Table 1—*Key Elements of the 2005 Intermountain Healthcare Pneumonia Guideline Logic*

Outpatients
Admission-decision support (CURB-65)
Default outpatient antibiotics
Oral doxycycline or oral azithromycin for mild pneumonia
Ceftriaxone or oral amoxicillin plus oral doxycycline or oral azithromycin for moderate pneumonia
Antibiotic administration in the outpatient site of diagnosis prior to hospital admission
Influenza and pneumococcal vaccinations
Inpatients
Two blood cultures prior to antibiotics, sputum Gram stain, and culture if available
Pneumococcal and Legionella urinary antigens for patients with severe pneumonia
Default inpatient antibiotics
Ceftriaxone plus oral doxycycline or oral azithromycin for moderate pneumonia.
IV azithromycin plus ceftriaxone or imipenem for severe pneumonia
Enoxaparin for prophylaxis against deep venous thrombosis
Early ambulation

*From the Division of Pulmonary and Critical Care Medicine (Dr. Dean), LDS Hospital, University of Utah School of Medicine; HealthInsight (Dr. Bateman, Dr. Donnelly, and Mr. Silver); and Intermountain Healthcare (Drs. Snow and Hale), Salt Lake City, UT.
The authors have no relevant conflicts of interest to report.
This study was funded by the Deseret Foundation and HealthInsight, Salt Lake City.
The analyses upon which this publication is based were performed under contract No. 500–02-UT01, funded by the Centers for Medicare and Medicaid Services, an agency of the US Department of Health and Human Services. The content of this publication does not necessarily reflect the views or policies of the Department of Health and Human Services, nor does mention of trade names, commercial products, or organizations imply endorsement by the US government. The authors assume full responsibility for the accuracy and completeness of the ideas presented.
Manuscript received December 1, 2005; revision accepted February 25, 2006.

Correspondence to: Nathan C. Dean, MD, FCCP, Intermountain Healthcare, 333 South Ninth East, Salt Lake City, UT 84102; e-mail Nathan.Dean@Intermountainmail.org.
DOI: 10.1378/chest.130.3.794