Delays in Suspicion and Isolation Among Hospitalized Persons With Pulmonary Tuberculosis at Public and Private US Hospitals During 1996 to 1999*

Julia Rozovsky-Weinberger, MD; Jorge P. Parada, MD, MPH; Laura Phan, MPH; David G. Droller, MD; Maria Deloria-Knoll, PhD; Joan S. Chmiel, PhD; and Charles L. Bennett, MD, PhD, MPP

Background: **While prior studies have shown that public and private hospitals differ in their rates of suspicion and isolation of patients who are at risk for tuberculosis (TB), no study has investigated whether this variation is due to differences in the impact of patient case-mix on hospitals or to variations attributable to specific hospital practice patterns.**
Objective: **To investigate patient-level and hospital-level factors associated with delays in TB suspicion and isolation among inpatients with pulmonary TB disease.**
Design: **Retrospective cohort study of patients hospitalized with culture-positive pulmonary TB during 1996 to 1999.**
Setting: **Patients with culture-proven pulmonary TB treated at three public hospitals (765 patients) and seven not-for-profit private hospitals (172 patients) in Chicago, Los Angeles, and southern Florida that provided care for five or more patients with TB per year during the study period.**
Measurements: **Two-day rates (within 48 h from admission) of acid-fast bacilli (AFB) smear orders and 1-day rates (within 24 h from admission) of TB isolation.**
Results: **Two-day rates of ordering AFB smears were > 80% at three public and two private hospitals vs 65 to 75% at five private hospitals. One-day rates of TB isolation at the three public hospitals were 64%, 79%, and 86%, respectively, vs 39 to 58% at the seven private hospitals. Delays of > 2 days in ordering AFB smears were associated with patient-level factors: absence of cough (adjusted odds ratio [AOR], 6.02; 95% confidence interval [CI], 3.82 to 9.52), cavitary lung lesion (AOR, 5.17; 95% CI, 1.98 to 13.50), night sweats (AOR, 3.38; 95% CI, 1.90 to 5.99), chills (AOR, 1.70; 95% CI, 1.01 to 2.88), and female gender (AOR, 1.66; 95% CI, 1.06 to 2.60). Delays of > 1 day in ordering pulmonary isolation were associated with patient-level factors: absence of cough (AOR, 3.40; 95% CI, 2.31 to 5.03), cavitary lung lesion (AOR, 2.66; 95% CI, 1.57 to 4.50), night sweats (AOR, 1.98; 95% CI, 1.35 to 2.92), and history of noninjecting drug use (AOR, 1.86; 95% CI, 1.16 to 2.99) and one hospital-level factor: receiving care at a nonpublic hospital. Even after adjustment for patient-level factors, TB patients at private hospitals were half as likely as those at public hospitals to be placed in pulmonary isolation (AOR, 0.47; 95% CI, 0.30 to 0.72), while odds of suspecting TB in these same patients were similar at both hospitals.**
Conclusion: **Private hospitals should order TB isolation for all patients for whom AFB smears are ordered, a policy that has been instituted previously at public hospitals in our study.**
(CHEST 2005; 127:205–212)

Key words: nosocomial outbreak of tuberculosis; patterns of care; quality of care

Abbreviations: AFB = acid-fast bacilli; AOR = adjusted odds ratio; ATS = American Thoracic Society; CDC = Centers for Disease Control and Prevention; CI = confidence interval; MDR-TB = multidrug-resistant tuberculosis; TB = tuberculosis

Tuberculosis (TB) reemerged as an important public health problem shortly after the AIDS epidemic began.[1–3] Factors attributed to this resurgence include a decline in support for the public health infrastructure, co-infection with HIV, an increasing immigrant population, and nosocomial outbreaks of TB in prisons, nursing homes, hospitals, and shelters.[4–8] Several studies[5,6,9–15] in the mid-

1980s identified problems in hospital care such as delayed recognition and management of tuberculosis. In several instances, these were followed by nosocomial outbreaks of multidrug-resistant TB (MDR-TB). In a 1990-to-1993 evaluation from New York conducted following outbreaks of MDR-TB, Frieden et al[13] identified 267 TB patients with isolates resistant to isoniazid, rifampin, ethambutol, streptomycin, and rifabutin. Remarkably, 67% of these patients had acquired their disease through nosocomial transmission. Many patients remained infectious from disease onset to death, did not survive the hospitalization, and were located on wards with other individuals with HIV infection. In a 1988-to-1996 evaluation of 206 TB inpatients in eight hospitals in St. Louis, 25% experienced delays in TB suspicion and in the implementation of standard infection control practices.[11] In 1994 and 1996, recommendations for the prevention of nosocomial transmission were published by the Centers for Disease Control and Prevention (CDC) and the American Thoracic Society (ATS).[16,17] These recommendations included early identification of patients who may have infectious TB and prompt implementation of TB infection control precautions for such patients.[16,17]

Even after publication of these recommendations, problems in the quality of inpatient TB care persisted.[18–21] In a 1995-to-1997 evaluation of 1,227 HIV-infected patients with pneumonia who received care at 44 hospitals in New York, Chicago, or Los Angeles, only 66%, 63%, and 24% of the patients in the three study regions, respectively, were placed in pulmonary isolation during the first 2 hospital days.[18] Rates of ordering TB isolation were highest at public vs private hospitals, despite rates of TB suspicion being similar at the two types of hospitals.[18,19] In a study of TB care at four hospitals in Chicago during 1994 to 1996, TB patients as well as HIV-infected patients with pneumonia who received care at a county vs a private hospital were significantly more likely to have been placed in pulmonary isolation.[21] Moreover, a nosocomial outbreak of MDR-TB occurred at one private hospital with low rates of use of pulmonary isolation rooms for TB patients.[21]

While hospitals vary in TB practices, it is not known if these variations are primarily due to higher rates of high-risk TB patients at certain hospitals (case-mix or patient-level effects) or to variations in hospital-specific practices (hospital-level effects). In this study, we evaluated patient-level and hospital-level factors associated with delays in suspicion and isolation of TB patients during the years from 1996 to 1999 at three public and seven private hospitals in Los Angeles, Chicago, and Miami, three cities with large numbers of cases of TB.

Materials and Methods

Data

Thirty-one randomly selected public, for-profit, or not-for-profit hospitals in Chicago, Los Angeles, and Miami have participated in a series of studies of *Pneumocystis carinii* pneumonia and community-acquired pneumonia over the past decade.[22–24] From these 31 hospitals, a random sample of 12 hospitals were selected for consideration for this study. Of these 12 hospitals, 10 hospitals that treated five or more patients with culture-confirmed TB per year (for the years 1996 to 1999) agreed to participate in this study. Medical records for all patients with TB who received care at the study hospitals during 1996 to 1999 were reviewed. Cases were identified from reviews of hospital microbiology logbooks. All patients > 18 years of age with a positive culture finding for *Mycobacterium tuberculosis* were entered into the study database. The study was approved by the Institutional Review Board at Northwestern University and at each of the study hospitals prior to initiation of data collection. Hospital, patient, and physician confidentiality were maintained throughout the study.

Nurses reviewed inpatient medical records of each patient using a standardized data collection form. Standard risk factors, as defined by the ATS and the CDC,[8] for tuberculous infection and for development of tuberculous disease after infection were sought from the medical record. The following presenting signs and symptoms at the time of hospitalization were recorded: cough, fever, night sweats, chills, shortness of breath, wheezing, chest pain, and weight loss. The findings from chest radiography done at hospital admission were also recorded. The type of pulmonary tuberculous disease was recorded by using the following descriptors: smear-positive sputum, cavitary, and others. Factors associated with high-risk for TB were recorded: HIV infection, drug use, homelessness, foreign birth, incarceration, and/or cavitary lung lesion.

Statistical Analysis

A low-TB-risk patient was operationally defined by the following factors: absence of cavitary lung lesions on chest radiograph,

*From the Division of Pulmonary and Critical Care Medicine (Dr. Rozovsky-Weinberger), John H. Stroger Hospital of the Cook County, Chicago, IL; the Midwest Center for Health Services and Policy Research (Dr. Parada), Hines VA Hospital, Hines, IL; the Institute for Health Services Research and Policy Studies (Ms. Phan), and the Department of Preventative Medicine (Drs. Deloria-Knoll and Chmiel), Northwestern University Chicago, IL; the Division of Infectious Diseases (Dr. Droller), Broward General Medical Center, Ft. Lauderdale, FL; and the Midwest Center for Health Services and Policy Research (Dr. Bennett), Chicago, IL.
This study was supported in part by grants from the Chicago Community Trust and the National Institute of Drug Abuse (5RO1DA10628–02). Dr. Parada is a VA Career Development Award recipient.
Manuscript received December 30, 2002; revision accepted August 19, 2004.

Correspondence to: Charles L. Bennett, MD, PhD, MPP, Jesse Brown VA Medical Center, 333 East Huron, Suite 277, Chicago, IL 60611; e-mail: cbenne@northwestern.edu.