

The following abstracts, from medical journals containing literature on community-acquired pneumonia and antibiotic resistance, were selected for their relevance to this Special Report supplement.

Improving Analysis and Management of Antibiotic-Resistant Bacteria

The need to reign in the growing list of antibiotic-resistant bacteria and reduce the effect on the healthcare system has prompted a call for more scientific surveillance data and epidemiologic, longitudinal studies. The association between the frequency of drug resistance and the degree of mortality in treated and untreated patients with common infections and the issues involved in drug resistance are discussed. The author defines a 3-stage sigmoid pattern of resistance: 1) a lengthy period during which a bacterial variant remains at frequencies too low to detect, 2) a period of rapid change, and 3) a period of slow change until stability is achieved. The speed of change the new variant undergoes is discussed, as well as the speed of emergence of a variant. Studies in Finland and Iceland have demonstrated that the frequency of drug resistance can be reduced by lowering the selective pressure and increased by raising it. The importance of rotating the use of drugs, taking into consideration the type of infection, the properties associated with antibiotics used in the treatment, and the epidemiologic setting to vary the selective pressure is discussed. The author concludes that surveillance methods to record population movements between countries and methods of sample collection and detection should be improved and used by a greater number of countries to help clarify the definition of antibiotic resistance. Combining population genetics, ecology, and mathematical biology may be required to help slow the spread of drug resistance.

Anderson RM. The pandemic of antibiotic resistance. *Nature Med* 1999;5:147-149

Length of Stay for Patients With Community-Acquired Pneumonia

A physician survey was conducted to determine discharge decisions surrounding patients who were hospitalized with community-acquired pneumonia. A total of 418 of 475 patients enrolled in the Pneumonia Patient Outcomes Research Team cohort study were eligible for the study. Questionnaires were completed for 332 patients at 4 study sites. Discharge decision questionnaires were completed by 168 physicians who treated eligible patients at these sites. Clinical stability determining eligibility for hospital discharge was chiefly decided by when temperature returned to normal; respirations, mental status, and oxygenation returned to baseline; and the patient was able to maintain oral intake. Only 4% of patients were considered not clinically stable at discharge. Seventy-one patients were considered to have remained in the hospital beyond the time they were deemed fit for discharge.; the median time beyond attainment of clinical stability was 2.5 days. The median length of stay of the 157 low-risk patients was 7 days for 29 patients who remained hospitalized beyond the point of stability and 5 days for the 128 remaining patients. The median length of stay of the 155 medium- and high-risk patients was 12.5 days for 42 patients who were hospitalized beyond the point of stability and 8 days for the remaining 113 patients. Extended length of stay was most often associated with a diagnosis of comorbidity (56%), completion of a standard course of antimicrobial therapy (15%), difficulty with arrangements for long-term care (14%), and delays in social service consultation (13%). Services that were definitely or probably associated with an earlier hospital discharge included home intravenous antimicrobial treatment (26%), home visits by nurses (20%), and home visits by physicians (16%).

Fine MJ, Medsger AR, Stone RA, et al. The hospital discharge decision for patients with community-acquired pneumonia. *Arch Intern Med* 1997;157:47-56.

Hospitalization for Community-Acquired Pneumonia After Outpatient Treatment

A study was conducted to determine the incidence and causes of community-acquired pneumonia (CAP) and to assess the outcomes of patients who were hospitalized with CAP within 30 days of receiving outpatient treatment. A subset of 2287 enrollees in the Pneumonia Patient Outcomes Research Team study, a multicenter, prospective, cohort study of patients with CAP, were identified. Of these, 1337 were admitted to a hospital at presentation, and 944 received initial treatment on an outpatient basis; the latter group constituted the patient population for this study. A total of 71 patients (7.5%) were hospitalized within 30 days of treatment for CAP; of these, 33 patients had worsening symptoms or signs of CAP, and 7 patients had an adverse reaction to an antibiotic prescribed for CAP. Patients with a CAP-related reason were hospitalized for a mean of 4.9 days from presentation compared with 13.6 days for patients with a comorbidity. Patients who were subsequently hospitalized had a higher rate of mortality (4.2% versus 0.3%) compared with patients who were not hospitalized. Patients who were subsequently hospitalized took a median of 14 days to return to usual activities, compared with 6 days for patients who were not hospitalized. Thirty days after study enrollment, 88% of patients who were subsequently hospitalized and 93% of patients who were not hospitalized had returned to their usual activities. The incidence of hospitalization within 10 days of beginning outpatient treatment for CAP may be used as a screening tool for unsatisfactory quality of care in this illness.

Minogue MF, Coley CM, Fine MJ, Marrie TJ, Kapoor WN, Singer DE. Patients hospitalized after initial outpatient treatment for community-acquired pneumonia. *Ann Emerg Med* 1998;31:376-380.

Antimicrobial Use and Costs in Patients With Community-Acquired Pneumonia

There is substantial variation in antimicrobial prescribing patterns for patients with community-acquired pneumonia (CAP). Conducted as part of the Pneumonia Patients Outcomes Research Team study, this substudy sought to compare the patterns of antimicrobial use at 5 medical institutions and to assess the relationship between use, cost of antimicrobials, and medical outcomes in ambulatory and hospitalized patients with CAP. It was assumed that prescribing practices would vary substantially across treatment sites, resulting in large differences in antimicrobial costs and few differences in medical outcomes across sites. The study population comprised 927 outpatients and 1328 inpatients for whom antimicrobial therapy had been prescribed for the 30 days after presentation and about whom information was available. There was a significant variation by site in the rates of previous antimicrobial use for outpatients (14.8% to 34.4%) and inpatients (18.8% to 26.5%). There was also a marked variation in antimicrobial use for 18 of 20 and 17 of 23 parenteral antimicrobial agents in 13 classes that were prescribed for at least 2% of inpatients and outpatients, respectively, at 1 or more study sites. The median duration of antimicrobial therapy for outpatients ranged from 11 to 13 days for outpatients and from 13 to 15 days for inpatients. The median costs of antimicrobial therapy ranged from \$10.80 to \$58.90 for outpatients and from \$183.70 to \$315.60 for inpatients. Differences in costs were accounted for by the specific agent prescribed rather than by the number of agents prescribed or the duration of treatment. The use of less costly agents did not result in poorer medical outcomes. Mortality and hospital readmission did not significantly differ among sites after adjusting for differences in patient demographics, comorbidity, and severity of illness. Although differences in antimicrobial usage across institutions varied widely by site and resulted in significant differences in costs, they did not result in poorer medical outcomes. Use of narrow-spectrum agents and pharmacy-directed, less costly agents that provide therapeutic equivalence and placing emphasis on rapid conversion from parenteral to oral antimicrobial therapy to replace high-cost agents can reduce antimicrobial costs without adversely affecting outcomes.

Gilbert K, Gleason PP, Singer DE, et al. Variations in antimicrobial use and cost in more than 2000 patients with community-acquired pneumonia. *Am J Med* 1998;104:17-27.

Time to Stability in Community-Acquired Pneumonia

Variations in the length of hospital stay associated with community-acquired pneumonia (CAP) that suggest clinical uncertainty or differences in practice style have led to the development of practice guidelines and critical pathways to reduce the length of stay and cost of care for pneumonia. A prospective, multicenter, observational cohort study—part of the Pneumonia Patient Outcomes Research Team study, which assessed outcomes in hospitalized and ambulatory patients with CAP—was conducted to determine the time to resolution of vital signs, the ability to eat, and mental status abnormalities in hospitalized patients; the risk of adverse outcomes after vital sign stability was achieved; and the opportunities to shorten the length of stay. A total of 686 adults with CAP were observed. The median time to stability was 2 days for heart rate (≤ 100 beats/min) and systolic blood pressure (≥ 90 mm Hg); 3 days for respiratory rate (≤ 24 breaths/min), oxygen saturation ($\geq 90\%$), and temperature ($\leq 37.2^\circ\text{C}$ [99°F]). Overall clinical stability occurred in a median time of 3 days for the most lenient definition of stability and 7 days for the most conservative definition. Patients with more severe cases of CAP required more time to achieve stability. Clinical deterioration that warranted admission to intensive care, coronary care, or the telemetry unit after achieving clinical stability occurred in 1% or less of cases. The median hospital length of stay was 6 days. The majority of patients ($>83\%$)—regardless of the definition of stability applied—stayed in the hospital more than 1 day after reaching stability. Only 29% to 46% of patients had parenteral antibiotic therapy discontinued or were converted from parenteral to oral therapy within 1 day of reaching clinical stability. Using objective criteria, such median time to stability of vital signs and clinical status abnormalities may help prevent unnecessarily long hospital stays.

Halm EA, Fine MJ, Marrie TJ, et al. Time to clinical stability in patients hospitalized with community-acquired pneumonia: Implications for practice guidelines. *JAMA* 1998;279:1452-1457

Macrolides in Community-Acquired Pneumonia

Researchers sought to identify associated clinical parameters, concurrent respiratory tract infections, and the association between macrolide-based therapy and mortality in patients with community-acquired pneumonia (CAP) attributable to atypical pathogens. There were 385 consecutive patients admitted to a tertiary care hospital for CAP in 1990 and 1991 who were included in this prospective, cross-sectional study. Researchers were able to identify an atypical pathogen in 29 of the 385 adult patients, and a second pathogen was detected in 16 of the 29 in whom an atypical pathogen was found compared with 13 of 137 patients in whom conventional bacterial pathogens were detected. During hospitalization, only 4 patients with atypical pathogens received at least a 7-day course of either a macrolide or tetracycline. No patient who was identified as having an atypical pathogen died. For patients who either provided paired sera or who died, 24 of 197 had atypical pathogens detected. Despite vigorous study methods, atypical pathogens were uncommon in this patient population. A second concurrent respiratory pathogen was identified for most patients with atypical pneumonia. Although macrolide use was rare in this study, mortality was zero for patients in whom an atypical pathogen was detected. This finding affirms the hypothesis that macrolide-based therapy does not need to be routine in the therapeutic management of CAP.

Mundy LM, Oldach D, Auwaerter PG, et al. Implications for macrolide treatment in community-acquired pneumonia. Hopkins CAP Team. *Chest* 1998;113:1201-1206.