Antimicrobial Selection and Length of Hospital Stay in Patients with Community-Acquired Pneumonia

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Objective: To evaluate the relationship between antimicrobial selection and length of hospital stay (LOS) in patients with community-acquired pneumonia (CAP).

Design: Retrospective, observational, multicenter study.


Measurements: Demographic information, data to calculate a pneumonia severity index (PSI) score, type of antimicrobial therapy, LOS, and treatment outcome (successful or unsuccessful therapy or death) were retrieved from patients’ medical records. An analysis of covariance model with PSI score as a continuous variable and with categorical factors for antimicrobial regimen and treatment site was used to compare LOS for various antimicrobial regimens.

Results: Significant predictors of LOS included PSI score ($P < 0.001$), treatment site ($P = 0.015$), and initial regimen ($P = 0.017$). Initial regimens that included atypical pathogen coverage were associated with a mean LOS that was 1.8 days shorter than the LOS associated with regimens that did not provide such coverage ($P = 0.008$). A subgroup analysis of patients who remained on the same regimen throughout their hospitalization (excluding intravenous-to-oral switch) showed that those who continued to receive a regimen that provided atypical coverage had a mean LOS that was 3.3 days shorter than that of patients who continued to receive a regimen that did not provide atypical coverage ($P < 0.001$).

Conclusions: This study supports the association between a decreased LOS and initial therapy that provides atypical coverage. This association remains significant for patients who continue their initial regimen for the duration of hospitalization. Empiric therapy that includes coverage for atypical pathogens may be important in reducing the cost of care for CAP.

Community-acquired pneumonia (CAP) is associated with significant morbidity and mortality. In the United States, 3.3 million to 4 million people develop CAP annually, and approximately 20% of these are admitted to hospital [1]. Among outpatients, the mortality rate is low, ranging from less than 1% to 5% [2]; however, mortality averages 12% among patients requiring hospital admission and is almost 40% in those admitted to the intensive care unit (ICU) [2]. Although the majority of patients with CAP are treated in the community, the cost of treating those admitted to hospital is approximately 90% of the total cost of care budget for CAP [3], which is estimated to be approximately $9 billion annually [4]. Due to these costs, an emphasis is placed on reducing the length of hospital stay (LOS) of patients while maintaining the quality of care wherever possible.

It is often difficult to determine the etiology of CAP due to problems with obtaining valid specimens and a marginal probability of recovering the causative organism(s) from the specimens. Thus, CAP treatment is often empiric, based on knowledge of the most probable organisms and the local hospital microbiology summary data. Generally, the organisms most commonly associated with CAP are *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Mycoplasma pneumoniae*, *Chlamydia pneumoniae*, and *Legionella pneumophila* [5–7]. The selection of empiric antibiotic therapy is frequently based on...
the patient's history and clinical presentation, but the decision is complicated by changing patterns of antibiotic susceptibility among the causative pathogens, especially *S. pneumoniae* and the need to cover *Staphylococcus aureus* and gram-negatives other than *H. influenzae* in select patient populations. Because of cost constraints and the increasing prevalence of antibiotic resistance, great emphasis is placed on the selection of appropriate antimicrobial regimens.

The aim of this study was to evaluate the relationship between the initial choice of antibiotic agent and LOS in patients with CAP, with a focus on those agents that cover for an atypical respiratory pathogen compared with those that do not. The analysis included corrections for severity of illness (the factor that would logically impact most on LOS) and site of care (hospital). A secondary endpoint of this study was the duration of intravenous (IV) therapy.

**Methods**

**Design**

This was a retrospective, observational, multicenter study conducted between January 1999 and April 2000. Each of 9 hospitals from different geographic regions of the United States (Northeast, Southeast, Southwest, Great Lakes, Mid-Atlantic, and West) provided data from medical records for 50 consecutive patients meeting study criteria. All of the sites were teaching hospitals. Five of the sites used a decision pathway for the management of CAP.

Patients were included if they were older than 18 years of age, had a diagnosis of CAP according to ICD-9 criteria (code 486) or DRGs (79, 86, 89, 90), and chest X-ray evidence of CAP. Exclusion criteria for patients included a history of cystic fibrosis or immunocompromise, HIV infection, solid organ transplant, neutropenia, a history of CAP requiring hospitalization within the previous 14 days, being a resident of a long-term care facility, or being recently transferred from another hospital. Blood and/or sputum samples were collected at the discretion of the treating physicians.

Full Investigational Review Board or Human Investigations Committee approval to collect data was obtained at all sites before the study commenced.

**Data Collection**

A Microsoft Access-based software computer program was used for data entry at each investigation site, which allowed for uniformity across all study sites. The software program was designed to collect data on the treatment of CAP using predefined lists of outcomes and empiric drug regimens. These lists reflected the most commonly utilized antibiotic regimens based on literature review. All lists were created and approved by each of the authors prior to the start of data collection. The data extraction personnel were trained by the same person at each of the different sites. At the conclusion of data collection, each database was verified by the site investigator and submitted for analysis.

Data regarding the patient’s condition before treatment were used to calculate pneumonia severity index (PSI) scores [8]. Using a point system, the PSI stratifies patients into 5 risk classes based on factors such as age, comorbid conditions, physical examination findings, and laboratory results. Patients in class I and class II (≤ 70 points) have a 30-day mortality rate of less than 1% and are considered appropriate candidates for outpatient management. Patients in class III (71–90 points) have an associated 30-day mortality rate up to 2.8% and may receive inpatient management or outpatient management with close follow-up. Patients in class IV (91–130 points; mortality rate, 8.2%) and class V (> 130 points; mortality rate, 29.2%) should be hospitalized. Demographic information (age and sex) and any antimicrobial therapy received were recorded. Regimens with atypical coverage were defined as those containing azalide/macrolide or quinolone antibiotics. Other data collected included LOS (based on admission and discharge dates), discharge disposition (discharge to home, to an extended care facility, or in-hospital death), and the outcome of initial antibiotic therapy (defined as the first documented antibiotic therapy in the hospital medical record). Successful therapy was defined as maintenance of initial therapy, a switch from any initial IV therapy to any oral therapy prior to discharge, or therapy streamlined in light of microbiology results. Unsuccessful therapy was defined as the addition of a new antibiotic to the initial regimen, the discontinuation of the initial regimen and the addition of a new antibiotic regimen, or death. Change of an antibiotic regimen for administrative reasons (formulary or attending physician override) was not defined as treatment failure.

**Statistical Analysis**

The primary statistical test performed in this study was an analysis of covariance (ANCOVA), which was used to determine the relationship between LOS and initial antibiotic regimen. This analysis was conducted on the total patient population and on a subgroup of patients who started on an initial regimen and stayed on this regimen (other than IV-to-oral switches) for their entire stay in hospital. The primary statistical analysis was restricted to those therapies observed in 6 or more patients to permit estimates of standard deviations and confounding effects. The dependent variable in the model was LOS, and the variables of site and PSI score were added into the model as covariates to account for any variance introduced by these factors and to decrease the error term in the model.

An ANCOVA model was used to determine the relationship between the duration of IV therapy and the initial antibiotic treatment regimen. The dependent variable was duration of therapy and the covariates were site and PSI score.
Fisher’s exact test was used to compare the incidence of death and the incidence of unsuccessful therapy in patients relative to their initial treatment regimen. A $P$ value of $< 0.05$ was considered statistically significant.

Results

CAP was defined using ICD-9 criteria in 4 of the 9 study sites and by DRGs in the remaining 5 sites. A total of 450 patients were recruited to this study; 24 patients were excluded because they were treated in the emergency department and then discharged without hospital admission. Also excluded were 3 patients who had a LOS greater than 30 days (2 treated with ceftriaxone, 1 treated with a third-generation cephalosporin plus azithromycin; these were regarded as statistical outliers), 25 patients assigned to therapy groups with fewer than 6 patients (insufficient number of patients for statistical analysis), and 22 patients treated with therapies other than those in the menus of the computer program. The main statistical analysis, therefore, consisted of 376 patients.

Gatifloxacin was administered in only 1 of the study sites; therefore, patients who received gatifloxacin were combined with those receiving levofloxacin therapy to produce a combined quinolone group (analysis of the results from the levofloxacin patients alone was not different from the combined quinolone results).

Patient Characteristics

The mean age of the 426 enrolled patients was $62.9 \pm 17.0$ years, and their mean PSI score on day of admission was $85.4 \pm 32.8$ (PSI class III). The breakdown of patients according to PSI class was as follows: I, 18.9%; II, 22.1%; III, 22.4%; IV, 29.7%; V, 6.9%. The mean LOS was $5.6 \pm 5.4$ days, and 5.2% (22/426) of patients were admitted to the ICU. A total of 257 patients were started on IV therapy, and their antibiotic was not changed during hospitalization except to switch from IV to oral administration as their condition improved.

Initial Antibiotic Regimen

The initial antibiotic therapy administered is shown in Table 1. Of the 162 patients treated with a third-generation cephalosporin, 158 were treated with ceftriaxone; the remainder were treated with ceftaxime (3) and ceftazidime (1). The initial PSI score of patients relative to their initial therapy is shown in Table 2. Six of the 8 initial therapy groups had a mean PSI score corresponding to class III. Patients in the piperacillin-tazobactam and ceftriaxone monotherapy groups had a mean PSI score in the class IV range.

Microbiologic Findings

In the entire study population ($n = 426$), 294 patients had reported blood cultures; of these, 178 (60.5%) had cultures drawn prior to antibiotic therapy. In total, 489 blood cultures, 157 sputum Gram stains, 165 sputum cultures, 76 Legionella urine cultures, 5 Legionella sputum cultures, and 3 Chlamydia tests were performed. A presumptive microbiologic diagnosis was obtained for 12.7% (54/426) patients. All such diagnoses were achieved by culture of sputum and blood samples. In these 54 patients, S. pneumoniae was cultured from 14 (25.9%), H. influenzae from 4 (7.4%), and M. catarrhalis from 1 patient (1.9%). Other pathogens isolated included S. aureus, coagulase-negative staphylococci, Escherichia coli, Pseudomonas aeruginosa,


**THERAPY AND LOS IN CAP**

Table 3. Adjusted Mean Length of Stay by Presence or Absence of Atypical Coverage and by Regimen

<table>
<thead>
<tr>
<th>Regimen</th>
<th>All Patients (n = 376)</th>
<th>Patients without Therapy Changes (n = 277)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adjusted Mean Days ± Standard Error</td>
<td></td>
</tr>
<tr>
<td>Atypical coverage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence (n = 306)</td>
<td>4.9 ± 0.23</td>
<td>4.3 ± 0.28</td>
</tr>
<tr>
<td>Absence (n = 70)</td>
<td>6.7 ± 0.57*</td>
<td>7.6 ± 0.75*</td>
</tr>
<tr>
<td>Initial regimen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ampicillin-sulbactam</td>
<td>6.1 ± 1.32</td>
<td>7.2 ± 1.98</td>
</tr>
<tr>
<td>Azithromycin</td>
<td>4.6 ± 0.46†</td>
<td>4.1 ± 0.53†</td>
</tr>
<tr>
<td>Cefuroxime monotherapy</td>
<td>7.3 ± 1.23</td>
<td>7.6 ± 1.40</td>
</tr>
<tr>
<td>Ceftriaxone monotherapy</td>
<td>6.5 ± 0.76</td>
<td>5.1 ± 0.93§</td>
</tr>
<tr>
<td>Ceftriaxone plus azithromycin</td>
<td>5.8 ± 0.76</td>
<td>5.1 ± 0.93§</td>
</tr>
<tr>
<td>Ceftriaxone plus erythromycin</td>
<td>6.3 ± 0.53</td>
<td>6.5 ± 0.72</td>
</tr>
<tr>
<td>Levofloxacin/gatifloxacin</td>
<td>4.5 ± 0.39†</td>
<td>4.0 ± 0.44‡</td>
</tr>
<tr>
<td>Piperacillin-tazobactam</td>
<td>7.0 ± 1.32</td>
<td>9.2 ± 1.75§</td>
</tr>
</tbody>
</table>

*Significant difference between presence and absence of atypical coverage (P < 0.05).
†LOS results associated with this therapy differed significantly from LOS results associated with cefuroxime monotherapy and ceftriaxone monotherapy (P < 0.05).
‡LOS results associated with this therapy differed significantly from LOS results associated with cefuroxime monotherapy, ceftriaxone monotherapy, and piperacillin-tazobactam (P < 0.05).
§These 2 therapies differed significantly from one another (P < 0.05).

Streptococcus species, *Candida* species, and combinations of these microorganisms. Overall, 19% (81/426) of patients were tested for *L. pneumophila*; none of these tests was positive. None of the atypical laboratory tests for respiratory pathogens was reported as positive.

### Length of Stay

Results from the ANCOVA analysis revealed that the PSI score was a highly significant predictor of LOS (P < 0.001). Other important predictors were treatment site (P = 0.015) and initial regimen (P = 0.017).

There were 2 adjusted mean analyses (each of which adjusted for treatment site and initial PSI score). The first included all patients (n = 376) and found that adjusted LOS was significantly shorter with azithromycin monotherapy, levofloxacin/gatifloxacin, and third-generation cephalosporin plus azithromycin compared with cefuroxime or ceftriaxone monotherapy (Table 3). None of the other antibiotic comparisons reached statistical significance. The second analysis (ie, patients without therapy changes) evaluated only patients who had remained on the same antibiotic throughout their hospitalization (other than IV-to-oral switches) (n = 277). In this group of patients, a significantly shorter adjusted LOS was also seen in those treated with azithromycin monotherapy, levofloxacin/gatifloxacin, or a third-generation cephalosporin plus azithromycin compared with cefuroxime monotherapy, ceftriaxone monotherapy, or piperacillin-tazobactam therapy. In addition, the group treated with a third-generation cephalosporin plus erythromycin had a significantly shorter LOS than the group treated with piperacillin-tazobactam. No other comparisons were statistically significant in this analysis.

In the comparison of patients with (n = 306) and without (n = 70) atypical respiratory pathogen coverage, those with coverage had a 1.8-day shorter adjusted mean LOS (P = 0.008) compared with those without coverage. This difference was more apparent in the patients who did not have any treatment changes. Those with atypical coverage had a 3.3-day shorter adjusted mean LOS (P < 0.001) compared with patients without atypical coverage.

#### Duration of IV Therapy

Analysis of the duration of IV therapy showed that PSI score (P = 0.004), treatment site (P = 0.012), and initial antibiotic regimen (P = 0.004) were all significant predictors. With adjustment for PSI score and treatment site, azithromycin monotherapy, third-generation cephalosporin plus azithromycin, and levofloxacin/gatifloxacin were all independently associated with a significantly shorter mean length of IV therapy compared with both ampicillin-sulbactam and piperacillin-tazobactam. There was no significant difference in duration of IV therapy between the combination regimen of third-generation cephalosporin plus azithromycin and the monotherapy levofloxacin/gatifloxacin group (Table 4).

#### Other Outcomes

There was no significant difference between the in-hospital death rate with each initial antibiotic regimen (P = 0.693), nor was the rate of unsuccessful therapy significantly different among the regimens (P = 0.134) (Table 5). The overall mortality rate in this study was 2%; the majority of patients were discharged home (86%) or to an extended care facility (12%). The PSI score was significantly greater for patients who died than for patients who were discharged (P < 0.05).

#### Discussion

LOS in patients with CAP is influenced by a variety of factors, including disease severity and hospital site [9]. In order to control for these factors, we used an ANCOVA statistical model to account for covariables to produce an accurate prediction of the role of initial antibiotic therapy in determining...
the LOS of a patient with CAP. Results showed a correlation between use of an initial antibiotic regimen covering for atypical respiratory pathogens and a shorter LOS. There were also positive correlations between LOS, the hospital site, and the presenting PSI score of the patient. In a climate of increasing emphasis on economic and effective treatment, reducing LOS can result in considerable cost savings. The estimated cost saving for a decrease in LOS of 1 day in CAP patients is $680 [10].

In this study, 12.7% of patients had a confirmed microbiologic diagnosis, suggesting that drug therapy was empiric in the majority of patients. This figure for confirmed microbiologic diagnosis was approximately as expected, as microbiologic identification was not an inclusion criterion for this study and testing was performed only if it was done as part of the clinician’s routine practice. A limitation of these microbiologic data is that they were obtained from the 5 sites that used DRGs to identify patients with CAP. The ICD-9 486 code used at the other 4 sites identifies CAP with unspecified organisms. It is possible that the etiology of CAP at these 4 sites differed considerably from that recorded at the DRG sites.

The overall mortality rate of 2.1% in this study is in contrast to the overall reported rate of 12% in patients with CAP [2]. This lower rate may be partially due to the study’s patient selection criteria, which included patients with an ICD-9 code of 486 (unspecified organisms) and excluded nursing home patients and thus may have yielded a less seriously ill study population. Based on PSI criteria, more than one third of the patients included in our study did not require hospitalization and could have been treated successfully as outpatients.

There is increasing awareness of atypical respiratory pathogens and the morbidity and mortality for which they are responsible. However, the need for initial empiric therapy that provides activity against these organisms is not universally accepted. Guidelines for treatment of CAP from the Infectious Diseases Society of America (IDSA) [5], Centers for Disease Control and Prevention (CDC) [11], and the American Thoracic Society (ATS) [2] recommend therapy that covers atypical as well as typical pathogens, because *M. pneumoniae, C. pneumoniae, and Legionella* species can account for up to 37%, 17%, and 13% of cases, respectively [2]. Beyond these guidelines, several studies of CAP patients have evaluated the outcome benefits associated with therapies that are active against atypical pathogens. For example, a nonrandomized, prospective, observational study by Dudas and colleagues [12] and a chart review study by Mufson and Stanek [13] found that use of a macrolide in addition to the reference therapy was associated with a significant reduction in the mortality rate [12,13] and a decrease in LOS [12]. The importance of timely coverage of atypical respiratory pathogens was also demonstrated by Stahl and colleagues [14]. Patients who received a macrolide within 24 hours of hospital admission had a markedly shorter mean LOS than patients who did not. This benefit diminished as the interval before admission and administration of a macrolide increased.

A retrospective, chart review study by Gleeson and colleagues [15] evaluated the association between initial antimicrobial therapy and medical outcomes for hospitalized elderly patients (> 65 years of age) with pneumonia. This study demonstrated a reduced mortality rate for patients treated initially with a second-generation cephalosporin plus a macrolide, a third-generation cephalosporin plus a macrolide, or a fluoroquinolone alone. The LOS analysis demonstrated a longer LOS in patients on initial therapy with a third-generation cephalosporin alone, a β-lactam/β-lactamase inhibitor alone, a β-lactam/β-lactamase inhibitor plus a macrolide, or an aminoglycoside plus another agent, compared with patients receiving other categories of antimicrobial agents. Like Gleason, we observed an association between a use of a cephalosporin or a β-lactam/β-lactamase inhibitor alone and a longer LOS. However, it is clear that the 2 studies examined quite different patient populations. Whereas Gleason investigated a population aged ≥ 65 years, the mean age of our patient population was approximately 63 years.

A chart review study by Burgess and Lewis [16] demonstrated no significant difference in LOS between patients treated with a nonpseudomonal third-generation cephalosporin and patients treated with a nonpseudomonal third-generation cephalosporin plus a macrolide. One of the major limitations of this study is that the analysis was conducted on a specific subgroup of patients rather than the entire CAP population.

### Table 4. Adjusted Mean Duration of Intravenous Therapy by Initial Regimen*

<table>
<thead>
<tr>
<th>Initial Regimen</th>
<th>Adjusted Mean Days ± Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ampicillin-sulbactam</td>
<td>7.3 ± 1.92</td>
</tr>
<tr>
<td>Azithromycin</td>
<td>2.7 ± 0.53†</td>
</tr>
<tr>
<td>Cefuroxime monotherapy</td>
<td>4.6 ± 1.38</td>
</tr>
<tr>
<td>Cephalosporin (third generation) plus azithromycin</td>
<td>3.1 ± 0.38†</td>
</tr>
<tr>
<td>Cephalosporin (third generation) plus erythromycin</td>
<td>3.9 ± 0.90</td>
</tr>
<tr>
<td>Ceftriaxone monotherapy</td>
<td>4.3 ± 0.70</td>
</tr>
<tr>
<td>Levofloxacin/gatifloxacin</td>
<td>2.7 ± 0.47†</td>
</tr>
<tr>
<td>Piperacillin-tazobactam</td>
<td>8.9 ± 1.69</td>
</tr>
</tbody>
</table>

*Patients started on IV therapy without changes (n = 257); excludes patients on oral therapy alone from admission to discharge.
†IV therapy with this agent was independently significantly shorter than therapy with either ampicillin-sulbactam or piperacillin-tazobactam (P < 0.05).
This may have introduced a bias in the patient selection. In addition, data were collected in 2 hospitals, one a community hospital and the other a tertiary care hospital. It may be that a difference in LOS was not observed due to process factor differences between the hospitals that disguised differences in antibiotic therapy. The authors do not report the distribution of single-agent or macrolide-containing regimens between the 2 hospitals. Our study accounts for differences in hospital site by including this variable in the analysis.

Against this background, the findings of the present study show a benefit in terms of a significantly shorter LOS for those patients whose initial therapy provided atypical coverage. In addition, this study found a significant difference in LOS in the patients who started and stayed on such therapy for the duration of their hospitalization. Most of the studies described above evaluated the effect of macrolide inclusion only [12–14]. This study extends these findings by looking at wider atypical coverage. To our knowledge, this is the first study to evaluate atypical coverage as a composite of azalide/macrolide- and quinolone-containing treatment regimens and the effect of these antibiotic regimens on LOS based on initial therapy selection and continued treatment.

This study also evaluated the length of IV therapy by regimen type. The latest ATS guidelines for treating CAP patients [2] have suggested that patients can be discharged home the same day they are switched from IV to oral therapy (by fulfilling Ramirez criteria [17,18]) if there are no unstable coexisting illnesses or other life-threatening complications. Economic considerations therefore favor short IV therapy leading to rapid discharge of patients. Azithromycin and levofloxacin/gatifloxacin were the agents associated with the shortest time on IV therapy. The short IV course might be a reflection of the confidence of the treating physicians with the oral formulations of these particular antibiotics.

A study by Laing and colleagues [19] reviewed 231 patients with CAP treated with either an IV cephalosporin or an IV penicillin/macrolide. Length of IV therapy was significantly longer with IV cephalosporin (4.4 days) than with the penicillin/macrolide (3.3 days). Also, mean LOS was more than 2 days longer with cephalosporin therapy than with penicillin/macrolide therapy. A similar trend, although not statistically significant, was seen in the present study, where treatment with IV cephalosporin monotherapy was longer than IV therapy with azalide monotherapy, quinolone monotherapy, or combination therapy with cephalosporin plus macrolide/azalide groups. However, the longer time for patients to remain on IV therapy while receiving cephalosporin monotherapy in this study may have been due to a lack of confidence in, or lack of, an equivalent oral cephalosporin. IV agents used for the longest time were those with anaerobic coverage (ampicillin-sulbactam and piperacillin-tazobactam), which may be related to clinician suspicion of aspiration pneumonia. However, this conjecture was not confirmed, and all patients in the study were discharged with an ICD-9 or DRG code CAP diagnosis.

**Conclusion**

This study supports the link between a decreased LOS and atypical respiratory pathogen coverage for patients being treated for CAP. This study increases the evidence for including atypical respiratory pathogen coverage in empiric therapy for hospitalized patients with mild to moderately severe CAP.

**Table 5. Outcome of Initial Therapy by Regimen**

<table>
<thead>
<tr>
<th>Initial Regimen</th>
<th>Successful Therapy, n (%)*</th>
<th>Unsuccessful Therapy, n (%)*</th>
<th>Death, n [%]*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ampicillin-sulbactam</td>
<td>7 (100)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Azithromycin</td>
<td>53 (95)</td>
<td>3 (5)</td>
<td>0</td>
</tr>
<tr>
<td>Cefuroxime monotherapy</td>
<td>9 (100)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cefuroxime (third generation) plus azithromycin</td>
<td>119 (98)</td>
<td>0</td>
<td>2 (2)</td>
</tr>
<tr>
<td>Cefuroxime (third generation) plus erythromycin</td>
<td>36 (95)</td>
<td>2 (5)</td>
<td>0</td>
</tr>
<tr>
<td>Ceftriaxone monotherapy</td>
<td>45 (96)</td>
<td>2 (4)</td>
<td>0</td>
</tr>
<tr>
<td>Levofloxacin/gatifloxacin</td>
<td>83 (92)</td>
<td>5 (6)</td>
<td>3 (3)</td>
</tr>
<tr>
<td>Piperacillin-tazobactam</td>
<td>7 (100)</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: Numbers are for analyzed population only (n = 376).

*Comparison of incidences of unsuccessful therapy or death in patients over the 8 regimens using Fisher’s exact test showed that the differences in unsuccessful therapy or death rate among the regimens were not statistically significant.
and Aventis. Dr. Krebs performed statistical analysis for this study under contract to Pfizer.

Author contributions: conception and design, JFT; analysis and interpretation of data, JFT, CEL, MSF, WBK, TJL; drafting of the article, CEL, TJL; critical revision of the article for important intellectual content, JFT, RJA, CEL, PDB, MPG, FY, JSL, WK, DD, TJL; provision of study materials or patients, JFT, RJA, CEL, PDB, MSF, WK, JEB, MPG, FY, JSL, KPR; statistical expertise, WBK; obtaining of funding, TJL; administrative, technical, or logistic support, TJL; collection and assembly of data, RJA, MF, WBK, JEB, KPR, TJL; review of manuscript, KPR.

References