Use of Guidelines in Treating Community-Acquired Pneumonia*

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Study objectives: Guidelines for empiric treatment of community-acquired pneumonia (CAP) have been developed to assist in prescribing appropriate antimicrobials. We studied utilization of guidelines developed by the American Thoracic, Canadian Infectious Diseases, and Canadian Thoracic Societies (ATS, CIDS, and CTS, respectively), physicians’ familiarity with them, reasons that prompt deviation from them, and their effects on clinical outcomes.

Design: Two-part observational study, with prospective and retrospective groups.

Setting: A 1,100-bed, two-campus, tertiary-care teaching hospital.

Patients and participants: Patients admitted to the general medical ward who were being treated empirically for CAP and housestaff who provided their care.

Interventions: Medical residents reported on patients admitted to the hospital with CAP. The charts of all unreported patients admitted with CAP over the same period were reviewed.

Measurements and results: One hundred twenty-two patients were prospectively described and another 130 patients were identified retrospectively. There was no difference in guidelines adherence between the prospective and retrospective groups (81% compared with 80%; p=0.94). Deviation occurred most commonly in suspected aspiration. When physicians believed that they were following guidelines, this was true in 88%. When physicians believed that they were deviating, they were actually adhering in 46%. Guidelines adherence did not alter in-hospital mortality (12% compared with 14%, p=0.92) or length of hospitalization (median, 6 days for both groups).

Conclusions: ATS/CIDS/CTS guidelines for empiric treatment of CAP are widely used in our institution. Future amendments should address aspiration more explicitly. Residents’ familiarity with them could be improved. Beneficial effects on outcomes remain unproven.

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Key words: aspiration; guidelines; hospitalization; mortality; outcomes; pneumonia, community acquired

Abbreviations: ATS = American Thoracic Society; CAP = community-acquired pneumonia; CIDS = Canadian Infectious Diseases Society; CTS = Canadian Thoracic Society

Community acquired pneumonia (CAP) is a common disease with significant morbidity and mortality. Incidence rates reported in studies from the United States and Finland are between 10 and 14/1,000 persons per year.[1,2] Attack rates are highest at the extremes of age, with >30/1,000 of those aged ≥75 being affected yearly.[2,3] Mortality rates in recent studies varied between 8% and 16%,[4,5] depending on the study population. Clinical and radiographic features are not consistently reliable in the identification of a specific microorganism,[6-10] and despite extensive investigations, the etiologic agent remains unidentified in up to 50% of cases.[11-13] To assist in narrowing the spectrum of empiric antibiotic therapy, guidelines for the initial antimicrobial therapy in CAP have been proposed by several groups.[14-16] The guidelines of both the Canadian CAP Consensus Conference[15] (comprised of members of the Canadian Infectious Disease Society [CIDS] and the Canadian Thoracic Society [CTS]) and the American Thoracic Society (ATS),[14] are
similar. Thus far, they have been studied only in outpatients, and primarily addressing medical outcomes and antimicrobial costs. We set out to assess the utilization of these guidelines in inpatients in a tertiary-care teaching hospital, with specific interest in medical residents’ knowledge of the guidelines, reasons that prompt deviations from them, and their effects on clinical outcomes.

**Materials and Methods**

The study setting is a 1,100-bed, two-campus, tertiary-care teaching hospital (The Toronto Hospital). Inpatient medical care is provided by teams of housestaff, each of one second- or third-year (senior) medical resident, two first-year residents, and two medical students. General medical patients admitted to this institution are referred by the emergency physician to the on-call housestaff. They are assessed for hospital admission by one of the housestaff members, and initial treatment plans are reviewed with the senior medical resident.

Between February 1, 1996, and June 30, 1996, we asked all residents on the general medicine service to complete a questionnaire, at the time of admission from the emergency department, on all patients with possible CAP. Possible CAP was defined as a clinical suspicion high enough, based on the available data, that antibiotic treatment was warranted. Patients who were known to be positive for HIV, or otherwise immunosuppressed, and those with suspected tuberculosis were excluded. Demographic data, comorbidities, chosen antibiotics, and the rationale for this decision were recorded. We specifically asked if any guidelines had been considered in the choice of antibiotic therapy. If the answer was affirmative, we inquired if the choice was in accordance with the guidelines, and if not, why had they decided to deviate. We also asked if patients had been prescribed any antibiotics for this infection in the outpatient setting that they had used within the past 2 weeks. These patients formed the prospective group.

To assess for reporting bias, we identified from emergency department records all patients admitted to the medical service over the same period with diagnoses of CAP for whom questionnaires had not been completed. Our emergency department maintains a log of all patients admitted and of each admitting diagnosis (as determined by the admitting resident). These patients’ charts were reviewed by one of the authors, to collect as much of the data as possible to complete the questionnaires. Information was obtained exclusively from the admission note and physician’s order sheet. These patients formed the retrospective group.

Demographic data included age, sex, and whether the patient came from another institution, such as a nursing home. The comorbidities about which we specifically inquired included chronic obstructive lung disease, diabetes mellitus, chronic renal failure, congestive heart failure, chronic liver disease, hospitalization within the past year, suspected aspiration (based on the impression of the admitting medical resident), altered mental status, postneclectomy state, alcohol abuse, and malnutrition. These are conditions that have been outlined as relevant when applying the ATS guidelines. We did not collect data on microbiological etiology or diagnosis, but studied only initial empiric treatment of CAP. This protocol was approved by the Toronto Hospital Committee for Research on Human Subjects.

Our institution has its own Guidelines for Antimicrobial Use produced by the Antimicrobial Subcommittee of the Pharmacy and Therapeutics Committee as an aid to medical staff. This information is summarized in a handbook that is readily available to housestaff. The section discussing empiric treatment of pneumonia includes guidelines similar, but not identical, to those mentioned above.

For the purpose of determining guidelines adherence, we divided the combined prospective and retrospective groups into two categories. Members of the first group were <65 years of age and had none of the above comorbidities. The second group was composed of those of older age, with comorbidity, or both. For patients in the first group, the ATS guidelines would recommend a macrolide or tetracycline alone for less severe cases, or a second- or third-generation cephalosporin, with the option of adding a macrolide and rifampin, if the presentation was more severe. For patients in the second group with less severe illness, treatment consistent with the guidelines would include either a second-generation cephalosporin, trimethoprim/sulfamethoxazole, or penicillin plus a β-lactamase inhibitor with or without a macrolide. In severe disease, a macrolide plus or minus rifampin, and either a third-generation cephalosporin with antipseudomonal activity, imipenemcilastatin or ciprofloxacin, is recommended. We also studied outpatient antibiotic selection and its relation to patient outcomes. In the outpatient setting, the studied guidelines recommend the regimens listed above for less severe illness.

Categoric variables were compared using the χ² test with continuity correction or Fisher’s Exact Test when appropriate due to small sample sizes. Continuous variables (length of stay data) were compared using the Student’s t test. A p value of ≤0.05 was considered statistically significant.

**Results**

Two hundred fifty-five eligible patients were admitted to the hospital over the study period. One hundred twenty-two (45%) had questionnaires completed prospectively by housestaff, and 130 of the remaining 133 had their charts reviewed retrospectively (3 charts could not be located). Data on 252 patients were therefore available for analysis. Demographic, comorbidity, and guidelines adherence data comparing the two groups are summarized in Table 1. There were no significant differences in sex or age ratios, or in the fraction with older age, comorbidity, or both. Thirteen of the 252 patients (5%) were younger and without comorbidity, and 239 (95%) were older, with comorbidity, or both.

With respect to guidelines adherence, 99 of 122 subjects (81%) in the prospective group and 104 of 130 (80%) in the retrospective group were treated with regimens consistent with the studied guidelines (p=0.94). Ten of 13 younger patients (77%) without comorbidity were treated according to guidelines. Five of these received a second-generation cephalosporin, four a macrolide, and one a combination of the two. Nonadherent regimens in this group all included quinolones. Of the 239 patients who were older, with comorbidity, or both, 193 (81%) were prescribed antibiotics consistent with the guidelines. One hundred fifty-seven were treated with a second-generation cephalosporin alone, and 17 had a mac-
Table 1—Demographics, Comorbidities, Guidelines Adherence, and Outcome by Group

<table>
<thead>
<tr>
<th></th>
<th>Prospective (n=122)</th>
<th>Retrospective (n=130)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male, No. (%)</td>
<td>63 (52)</td>
<td>71 (55)</td>
<td>0.73</td>
</tr>
<tr>
<td>Age ≥65 yr, No. (%)</td>
<td>91 (75)</td>
<td>98 (75)</td>
<td>&gt;0.95</td>
</tr>
<tr>
<td>≥1 comorbidity, No. (%)</td>
<td>103 (84)</td>
<td>113 (87)</td>
<td>0.70</td>
</tr>
<tr>
<td>Age ≥65 yr and/or ≥1</td>
<td>116 (95)</td>
<td>127 (98)</td>
<td>0.44</td>
</tr>
<tr>
<td>comorbidity, No. (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guidelines adherence, No. (%)</td>
<td>99 (81)</td>
<td>104 (80)</td>
<td>0.94</td>
</tr>
<tr>
<td>Mortality, No. (%)</td>
<td>15 (12)</td>
<td>16 (12)</td>
<td>&gt;0.95</td>
</tr>
<tr>
<td>Length of stay, d</td>
<td>9.4/6</td>
<td>9.6/6</td>
<td>&gt;0.50</td>
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<tr>
<td>mean/median</td>
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</tbody>
</table>

*Mortality data available for 121 of 122 in prospective group and 130 of 130 in retrospective group.

Table 2—Mortality and Length of Stay by Guidelines Adherence

<table>
<thead>
<tr>
<th></th>
<th>Guidelines Adherence</th>
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<th>p Value</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Yes (n=201)</td>
<td>No (n=51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortality, No. (%)</td>
<td>24 (12)</td>
<td>7 (14)</td>
<td>0.92</td>
<td></td>
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<tr>
<td>Length of stay, d</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>9.9</td>
<td>8.1</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>6</td>
<td>6</td>
<td></td>
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</tbody>
</table>

*Mortality data available for 200 of 201 subjects treated according to guidelines.

Length of stay data available for 195 of 201 subjects treated according to guidelines and 48 of 51 not treated according to guidelines.

Rolide added to this. Eight patients were treated with trimethoprim/sulfamethoxazole alone, and two had a macrolide added to this. Six received monotherapy with a third-generation cephalosporin and three received this and a macrolide. Of the 46 cases of deviations from guidelines in this group, 31 were clindamycin-containing regimens (5 monotherapy, 13 with a second-generation cephalosporin, 5 with a third-generation cephalosporin, 4 with a quinolone, and 4 with an aminoglycoside). Other non-guideline regimens in this group included macrolide monotherapy (three), metronidazole plus a macrolide (four) or a β-lactam (four), a β-lactam and a quinolone (two), combination β-lactams (one), and quinolone monotherapy (one).

Reasons for guideline deviation could be assessed in the prospective group only. Residents indicated intentional deviation from the guidelines in 13 cases. In 7 of these 13, they did so to obtain more aggressive antimicrobial coverage for suspected aspiration pneumonia. In all of these, the selected regimens contained clindamycin, an antibiotic not recommended in the ATS guidelines. In the remaining six cases, there were five miscellaneous reasons and one response was not provided.

Through chart review, we were able to perform an outcome assessment according to guidelines adherence, assessing in-hospital mortality and length of stay. Both prospective and retrospective groups were combined to generate this analysis. There was no significant difference in length of stay or in-hospital mortality regardless of guidelines adherence (Table 2).

Sixty-one patients in this study had been prescribed outpatient antibiotics in the preceding 2 weeks. These patients were similar to those not previously treated, both in the fraction with at least one comorbidity or of older age and in mean number of comorbidities. The outpatient antibiotics prescribed were consistent with guidelines in 27 of 61 cases (44%). Of those treated in accordance with guidelines, 19 received a second-generation cephalosporin (1 had a macrolide added), 4 were treated with trimethoprim/sulfamethoxazole, 4 were treated with a penicillin plus β-lactamase inhibitor (1 had a macrolide added). Neither of the two patients without comorbidity were treated in accordance with guidelines—one received a quinolone and the other received a penicillin with a β-lactamase inhibitor. Of the remaining 32 patients who were not treated in accordance with guidelines as outpatients, 8 received a macrolide alone, 7 a quinolone, 7 penicillin monotherapy, 4 clindamycin-containing regimens, 2 a first-generation cephalosporin, 2 a macrolide with a non-guidelines drug, 1 tetracycline, and 1 metronidazole. In-hospital mortality according to outpatient therapy guidelines adherence did not significantly differ (15% vs 18% in the guidelines-adherent and nonguidelines groups, respectively, p>0.5). Also, overall mortality was not found to differ between those treated as outpatients and those first treated in hospital (16% vs 11%, respectively, p=0.37). Mean length of hospitalization did not differ significantly between those treated according to guidelines as outpatients and those treated with nonguideline outpatient antibiotics (9.5 compared with 7.6 days, respectively; p=0.10).

The design of the questionnaires allowed the comparison between the prescribing physician’s impression of guidelines adherence and the actual adherence (Table 3). When physicians believed that they were following the guidelines, this was true in 88% of cases. However, when physicians believed that they were deviating from the guidelines, this was found to be correct 54% of the time. When physicians were unsure as to whether they were following the guidelines, their choice was in accordance with guidelines in 64% of cases. Overall, physicians correctly judged whether they were following the guidelines in 85% of cases.
**Table 3—Physician's Impression of Guidelines Adherence**

<table>
<thead>
<tr>
<th>Impression of Guidelines Adherence</th>
<th>Actual Adherence (n=115)</th>
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<tbody>
<tr>
<td>Yes, No. (%)</td>
<td>77/89 (88)</td>
</tr>
<tr>
<td>No, No. (%)</td>
<td>6/13 (46)</td>
</tr>
<tr>
<td>Uncertain, No. (%)</td>
<td>9/14 (64)</td>
</tr>
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</table>

*Prospective group, n=122.  
Seven of 122 responses not provided.

**DISCUSSION**

This study, which assessed the utiliution of the ATS/CIDS/CTS guidelines for empiric treatment of CAP at a tertiary-care center, provides some insight into how the guidelines might be usefully modified and also attempts to address their effects on clinical outcome. The only similar published study of which we are aware studied outpatients and did not assess reasons for guidelines deviation. 

We found the guidelines to be widely used in our institution, with similar adherence rates of 81% and 80% in the prospective and retrospective groups, respectively. Since the groups are quite similar in this and other observed parameters, we believe that there is no significant reporting bias and it is thus valid to draw conclusions generalizable to the use of these guidelines in our institution from this data set. Despite relatively little organized dissemination of these guidelines, we found the compliance rate to be quite high. This may be related to the academic setting and to the fact that the physicians in question knew that their prescribing habits were being studied. Our adherence rate compares favorably with that of 67% reported from another teaching hospital in our region, which was based on a retrospective chart review of 1994 to 1995. This may indicate a trend toward increasing compliance over time. To further assess whether we had studied a representative group of patients, we looked at a recent retrospective study of CAP performed in our area. Our patients were similar in most demographic characteristics and had a similarly high degree of comorbidity. Of interest, mortality appeared slightly lower in our study (12.4% vs 16.3%), and the average length of stay we observed was 9.5 days, compared with the previously reported 16.3 days.

A new prediction rule to identify low-risk patients with CAP has been devised recently. Patients were divided into five classes depending on demographic findings, coexisting medical conditions, findings on physical examination, and laboratory and radiologic findings. Mortality was found to be consistently low (<3%) in the classes 1 to 3 and much higher in classes 4 and 5 (8 to 30%). This was born out in the validation groups. We are currently applying this rule to our group of patients. By stratifying our patient cohort according to this system, we plan to assess its utility in this setting.

This study was performed prospectively to determine the reasoning behind antibiotic selection. Our results suggest that, although the guidelines are being used extensively, the main clinical scenario in which intentional deviation occurs is that of suspected aspiration. This was similarly suggested by findings in a previous retrospective study. Residents seemed to favor the non-guidelines choice of clindamycin over the recommended combination of a penicillin and β-lactamase inhibitor. Since aspiration was the reason provided for noncompliance in 7 of the 13 cases, it would be useful if future versions explicitly address aspiration, as some published guidelines have already done.

It has been argued that clinical practice guidelines must be tested clinically to evaluate their effect on outcomes if they have been designed to improve patient care. Our study attempted to assess the studied guidelines in this fashion. We were unable to demonstrate any significant differences in mortality or length of hospitalization depending on guidelines adherence. This was also the case in the relatively small subset who received outpatient antibiotics prior to hospital admission. Analysis of length of stay data was also repeated with nonparametric testing (Mann-Whitney U) without altering the overall conclusions. In a study of 864 outpatients, Gleason and coworkers similarly showed no significant difference in mortality, and found an improvement in only 1 of the 10 studied indexes of morbidity (time to work—7 compared with 8 days in young people without comorbidity) in those treated according to guidelines. The lack of observed benefit does not prove that the guidelines lack efficacy. In the inpatient setting, outcomes may be difficult to improve, despite the use of effective guidelines recommending appropriate empiric antimicrobial therapy. Attending physicians have the luxury of close observation and the ability to react quickly to changes in clinical status and to results of readily accessible diagnostic studies. These circumstances could equalize potential differences between guidelines-adherent and nonadherent cohorts. Also, a heavy reliance on guidelines could lead to the practice of “cookbook” medicine and less vigilance in ongoing clinical assessment. This could negate any benefits produced by an initial guidelines-adherent antibiotic selection in the ambulatory or inpatient setting. Even if adherence does not result in superior clinical outcomes, treatment guidelines may still be valuable. They can be useful to generalists or primary care physicians who must deal with an extremely broad
range of medical problems. Guidelines present a summary of available evidence and the opinion of a group of experts, and thus provide pragmatic direction in the management of a specific condition. Guidelines may also serve to contain costs, improve patient satisfaction, and decrease physician error and practice variability. If guidelines are designed simply to disseminate a systematic way of caring for patients, rigorous testing is less important.20

Cost containment can be an appropriate role for guidelines, and analyzing our data lends some support to this contention. When intentional deviations were made in the setting of suspected aspiration, clindamycin—a more expensive drug—was often chosen over the guidelines-recommended combination of a penicillin and β-lactamase inhibitor. Further, when studying all guidelines deviations, it was found that many of the chosen regimens were more expensive than those recommended by the guidelines. Although we did not collect data on total antimicrobial and other costs, there is a suggestion that guidelines adherence is an effective and appropriate cost-containment measure.

We also observed that when physicians believed that they were deviating from the guidelines, they were actually prescribing in accordance with the guidelines about half of the time. This finding suggests that medical residents’ familiarity with the guidelines may not be optimal. If we are to accept the guidelines as valid and useful, even though they remain unproven, the issues of promoting their implementation and increasing physicians’ familiarity with them still remain. Although the rate of adherence was high in the setting of our study, the study in outpatients found an adherence rate of only 46%,17 and only 44% of patients in our study who received outpatient therapy were treated in accordance with the guidelines. There are several reasons why guidelines may not be successfully implemented. Clinicians may either be unaware of them or choose to deviate from their recommendations. Physicians may think of themselves as more informed than the experts, or pharmaceutical industry information may be perceived as better than that provided by the guidelines. Guidelines are most effectively implemented if they have the following characteristics: internally developed (physicians using them played a role in their design); disseminated by a specific educational intervention; and implemented with the aid of patient-specific reminders at the time of the patient encounter.21 If a representative group of local physicians are involved in adapting and implementing a set of widely disseminated guidelines, there would likely be greater guidelines familiarity and adherence. Electronic charting with automatic flagging of certain diagnoses might also both prompt physicians to consider and remind them of the specific content of relevant guidelines in certain clinical settings.

Our study has several limitations that deserve mention. The target group of physicians was a highly selected one—medical residents working in a teaching hospital who were aware that their prescribing habits were being monitored. The adherence rate in the retrospective group, when physicians were unlikely aware of practice monitoring, was similar to that in the prospective group, suggesting that the latter effect was not likely significant. We studied only a single institution, which may limit the generalizability of our conclusions, but similar findings in another study18 suggest that this may not be the case. The outcomes assessment is potentially both incomplete and lacking in sensitivity, as mentioned above, since we assessed only two variables, and the numbers were too small to confidently avoid a type II error. As noted above, however, our results are consistent with those observed in the outpatient application of these guidelines.17 A final and important issue involves our hospital’s own institutional guidelines for the empiric treatment of CAP, which are readily available to housestaff. They are found in the handbook described above, but there is no organized effort to ensure all housestaff have access to and follow the guidelines outlined within. The hospital CAP recommendations were adapted to be quite similar to the ATS guidelines in 1995, which could contribute to the high guidelines compliance we observed. Also, the hospital guidelines do specifically address aspiration, and one of the second-line recommendations for its treatment includes the use of clindamycin. It is unclear why this was a relatively popular choice when residents deviated from ATS guidelines, since selecting a penicillin is the hospital guidelines’ first-line recommendation.

We found that the ATS/CIDS/CTS guidelines for the treatment of CAP are widely used at our institution, but future amendments should more explicitly address the issue of aspiration pneumonia. Physician knowledge of the guidelines is generally good, but not optimal. Little beneficial effect of guidelines compliance on clinical outcomes has yet been demonstrated, so we must continue to work toward establishing their validity and making appropriate modifications as feedback becomes available.

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