# Poor adherence to South African guidelines for the management of community-acquired pneumonia

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*Objective.* To evaluate adherence to the South African guidelines for the management of community-acquired pneumonia (CAP) and to determine whether adherence reduced length of hospital stay and mortality in patients with severe CAP.

*Setting.* King Edward VIII Hospital, Durban.

*Methods.* Four hundred and thirty patients with CAP were recruited between June 2000 and October 2001. Severity assessment data were collected. Severe CAP was defined by the presence of two or more markers. Without influence from the investigators, the admitting team chose the empirical antibiotic regimen. Antibiotics administered, outcome and length of stay were analysed.

*Results.* Two hundred and eighty-seven of 430 patients were eligible for analysis. One hundred and eighty-two patients had two or more markers of severe CAP. Fourteen of the 182 patients (8%) had initial antibiotic therapy administered according to South African guidelines and 168 (92%) did not. The mortality rate was 20% (36 patients). Accounting for sample size there was no statistically significant difference in length of stay between the two groups (14 v. 12 days, $p = 1.0000$, odds ratio (OR) 1.167, 95% confidence interval (CI): 0.3926 - 3.467) or in mortality rate (28.5% v. 19%, $p = 0.3549$, OR 1.667, 95% CI: 0.667 - 4.161).

*Conclusion.* There was very poor adherence with South African CAP antibiotic guidelines. The sample size of patients receiving treatment according to the South African Thoracic Society (SATS) guidelines was too low to confirm confidently that adherence may have resulted in a clinical benefit.

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The choice of antibiotics in the initial treatment of community-acquired pneumonia (CAP) should cover the most likely pathogens and the pathogens most likely to cause severe disease. Guidelines have been published by a number of thoracic societies including the American Thoracic Society (ATS)[1] and the Working Groups of the South African Pulmonology Society and the Antibiotic Study Group of South Africa.[2]

Few studies have been conducted to confirm whether guidelines are being adhered to, or whether adherence to recommendations leads to improved patient outcomes as determined by cost effectiveness, length of hospital stay and patient survival.[3,4] Guidelines have not been validated prospectively.[5] Continuing medical education may have little effect on physician practice.[6-8] Published guidelines are therefore difficult to implement.

Use of macrolides as part of an initial therapeutic regimen appears to be associated with shorter length of hospital stay but has no effect on mortality.[9] Initial treatment with a second-generation cephalosporin plus a macrolide, or a fluoroquinolone alone may be associated with lower 30-day mortality compared with patients treated with a non-pseudomonal third-generation cephalosporin alone.[10]

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## Patients and methods

The study was conducted between June 2000 and October 2001. The admitting physician determined the initial antibiotic(s) administered. Severe CAP was defined as the presence of two or more of the following: age greater than 60 years, co-morbid disease (neoplastic disease, chronic renal failure, chronic liver disease, diabetes mellitus, heart failure), confusion, cyanosis, systolic blood pressure < 90 mmHg or diastolic blood pressure < 60 mmHg, respiratory rate ≥ 30 breaths/min, temperature > 38.3°C, involvement of 2 or more lobes on the chest radiograph, partial pressure of arterial oxygen < 60 mmHg, white blood cell count < 4 x $10^9$ cells/$mm^3$ or > 30 x $10^9$ cells/$mm^3$, urea > 7 mmol/l, and albumin < 30 mmol/l. Patients who were treated for pneumocystic pneumonia (PCP) or pulmonary tuberculosis (PTB) were excluded.

## Statistical analysis

Length of stay in days and in-hospital mortality rates were compared between patients whose antimicrobial therapy for severe CAP was consistent with and inconsistent with South African guidelines respectively. The unpaired *t*-test and Fisher's exact test were used in analysing the data.

## Results

Four hundred and thirty inpatients with CAP were recruited. One hundred and eighty-two fulfilled the study criteria. One

hundred and fifty-three of the 182 patients (84%) were HIV infected. The excluded 248 patients did not meet the criteria for severe disease, or had proven *Mycobacterium tuberculosis*, PCP, fungal pneumonia or were being treated empirically for PCP or PTB. The proportion of patients with each parameter considered as a marker of severe disease were: age > 60 years (2% of patients), co-morbid disease (9%), confusion (0%), hypotension (1%), involvement of 2 or more lobes (58%), respiratory rate ≥ 30 breaths/min (59%), temperature ≥ 38.3°C (53%), partial pressure of arterial oxygen < 60 mmHg (8%), white cell count < 4 x $10^9$ cells/$mm^3$ or > 30 x $10^9$ cells/$mm^3$ (9%), urea > 7 mmol/l (49%) and albumin < 30 mmol/l (82%). A total of 113 bacterial isolates were identified, 50% of these were *Streptococcus pneumoniae*. Atypical pathogens accounted for 21% of isolates.

Empirical antibiotic treatment for severe CAP consistent with South African guidelines was administered to 14 patients (8%) only. The remaining 168 patients (92%) were given treatment that was inconsistent with the guidelines. In the cohort of patients in whom the guidelines were followed, 9 subjects received intravenous second-generation cephalosporin and an aminoglycoside, 4 patients had intravenous amoxicillin-clavulanic acid and an aminoglycoside, and 1 patient received intravenous second-generation cephalosporin and a macrolide. In the cohort in which the guidelines were not followed, antibiotic regimens administered were as shown in Table I.

Thirty-six patients died, resulting in an overall mortality rate of 20%. Four patients (28.5%) died in the group that received treatment consistent with the South African guidelines while 32 patients (19%) died in the cohort whose antibiotic regimens were not consistent with the guidelines. The difference in mortality was not statistically significant ($p = 0.7106$).

There was no statistically significant difference in the mean length of hospital stay between the group in which the initial empirical antibiotic therapy was consistent with South African guidelines and the group in which the guidelines were not adhered to (14 days and 95% CI: 9.7 - 18.2 days v. 11.7 days and 95% CI: 10.3 - 13.1 days, $p = 0.3995$).

## Discussion

This study is the first to analyse the impact that South African CAP guidelines have had on physician practice, length of stay and mortality at a tertiary hospital. Most patients with severe CAP were treated with antibiotic regimens that were inconsistent with South African guidelines (92%). The majority of cases were treated with a second-generation cephalosporin alone (50.5%), intravenous penicillin alone (17%), or intravenous amoxycillin-clavulanic acid. There was virtually no cover for *Mycoplasma pneumoniae*, *Chlamydia pneumoniae* and *Legionella pneumophila* except in 1 patient who received a second-generation cephalosporin and a macrolide. The practice of not covering for the so-called 'atypical' pathogens probably stems from lack of clear evidence as to whether they are common pathogens or not in patients with CAP in South Africa.[11,12] In this study *M. pneumoniae*, *C. pneumoniae* and *L. pneumophila* accounted for 13%, 8% and 1% of isolates respectively.

There was no statistically significant difference in the length of hospital stay between the two cohorts. However, as only 14 of 182 patients were treated according to guidelines, the sample size may be too small to detect meaningful difference. The length of stay in both groups (14 days and 12 days respectively) is a reflection of the severity of illness combined with socio-economic deprivation. Besides the severity of illness, the high HIV seropositivity rate of 84% is an important consideration. Patients tend to have a multiplicity of problems such as wasting, general debilitation and dehydration.

Mortality was 28.5% and 19% in the patients who were given treatment consistent with and inconsistent with South African guidelines respectively. Although the group in which the guidelines were not followed appeared to have had a better outcome, this difference did not reach statistical significance ($p = 0.7106$). One factor that might have influenced these results is the small number of patients in the group who received treatment according to the published guidelines. A potential weakness of this study was the non-application of multiple logistical regression models to the confounding variable to

**Table I. Physicians' antibiotic choices in the cohort of patients whose antibiotic regimens were not consistent with the South African guidelines (*N* = 168)**

| Antibiotic choice | Number of patients | % |
|---|---|---|
| IV 2nd-generation cephalosporin ± fluoroquinolone | 86 | 51 |
| IV penicillin G ± fluoroquinolone/chloramphenicol/ aminoglycoside | 38 | 23 |
| IV amoxicillin-clavulanic acid ± fluoroquinolone | 29 | 17 |
| IV 3rd-generation cephalosporin ± IV flucloxacillin | 8 | 5 |
| Oral amoxicillin/erythromycin ± metronidazole | 5 | 3 |
| IV piperacillin and aminoglycoside/fluoroquinolone | 2 | 1 |

IV = intravenous.

adjust for the differences in mortality and length of stay in the two groups.

The study has shown that the South African guidelines have failed to significantly influence medical practice at a tertiary teaching hospital. There are several possible explanations.[3,6,8] These include lack of awareness, attitude, lack of knowledge of the guidelines and local barriers to implementation of the guidelines. In addition, physicians may feel that guidelines restrict their autonomy, freedom and clinical judgement. Possible solutions include continuing medical education, feedback and physicians' participation in efforts to have guidelines adopted and implemented, participation of administrators as well as regular guideline revision and auditing. Guidelines need to be flexible and to be scientifically validated.

This study brings into focus the issue of institutional policy regarding the use of antimicrobials. There is no institutional policy on the use of antibiotics in CAP within the medical domain at King Edward VIII Hospital. The failure to provide clear policy may be owing to various reasons including ignorance of the need for and advantages of well-formulated policies, fear of alienating professionals, a lack of or shortage of good managers, inadequate financial resources which might make such policies unworkable, and bureaucratic and political interference. Sound working relationships between institutional managers and clinicians are necessary for any policy to work. Erratic supplies of drugs would render any institutional policies unworkable. In the light of the data on compliance from this study, it is important to get some feedback from the clinicians regarding guidelines in general and the CAP guidelines in particular. This could be a follow-up study in the form of a questionnaire. Valuable data on knowledge, attitudes, fears, concerns and antibiotic practising habits could emanate from such a study. The study could provide answers for the poor adherence to the guidelines.

The South African Thoracic Society (SATS) CAP guidelines were recently revised.[13] Clear, workable strategies need to be devised to disseminate these guidelines to practising clinicians in an efficient and cost-effective manner. If the data from this study is a reflection of practice country-wide, a lot of work would be required to change physicians' practising habits. Although it may be argued that mortality is not necessarily altered by following guidelines, there are equally compelling reasons for the issue of guidelines to be pursued vigorously. These are cost effectiveness, rational prescribing and minimising the development of antibiotic resistance, among other reasons. Lastly, the revised SATS CAP guidelines emphasise the emergence of tuberculosis and PCP as common pathogens in the light of the HIV epidemic.

In conclusion, we have shown poor adherence to the CAP guidelines. A larger national multicentre study is required to validate current guidelines. Future studies should also focus on the reasons for non-compliance and the economic implications.

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