

# Admission is not always necessary for patients with community-acquired pneumonia in risk classes IV and V diagnosed in the emergency room

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**OBJECTIVE:** To determine the factors that allow patients with community-acquired pneumonia who are at high risk of mortality (risk classes IV and V) to be treated at home.

**DESIGN:** A prospective, observational study.

**SETTING:** Six hospitals and one free-standing emergency room in Edmonton, Alberta.

**PARTICIPANTS:** The present study included 2354 patients in risk classes IV and V who had a diagnosis of pneumonia made by an emergency room physician or an internist.

**MEASUREMENTS:** Symptoms, signs and laboratory findings, as well as outcome measures of length of stay and mortality.

**RESULTS:** Of the total study group, 319 of the patients (13.5%) were treated on an ambulatory basis. Factors predictive of admission were definite or possible pneumonia on chest radiograph as read by a radiologist, functional impairment, altered mental status, substance abuse, psychiatric disorder, abnormal white blood cell count, abnormal lymphocyte count, oxygen saturation less than 90% and antibiotic administration in the week before admission. If chest pain was present, admission was less likely. Only two of the 319 patients required subsequent admission (both had positive blood cultures) and only two died.

**CONCLUSIONS:** A substantial number of patients in risk classes IV and V can be safely treated at home. Factors that help clinicians to select this subset of patients are discussed.

**Key Words:** Admission decision; Pneumonia; Severity

Community-acquired pneumonia (CAP) is a common and serious illness affecting over five million people in the United States each year, of whom approximately 600,000 are hospitalized, resulting in a cost of approximately US\$9 billion per annum (1,2). In a carefully conducted study of CAP, Fine et al (3) developed a pneumonia-specific severity of illness scoring system based on 20 factors, including demographic, clinical and laboratory features. Patients were grouped into five risk classes for mortality – classes I to III (90 points or less) were at low risk for death, while the mortality rates were 9% in class IV and 27% in class V (3). Based on these data, the authors concluded that patients in risk classes I and II could generally be managed on an ambulatory basis and that patients in classes IV and V should be admitted (3). It should be noted that age is a major factor in this scoring system, because male

## L'hospitalisation des patients atteints de pneumonie non nosocomiale des catégories de risque IV et V diagnostiqués à l'urgence n'est pas toujours nécessaire

**OBJECTIF :** Déterminer les facteurs qui permettent de soigner à domicile les patients atteints de pneumonie non nosocomiale à haut risque de mortalité (catégories de risque IV et V).

**MÉTHODOLOGIE :** Étude prospective par observation.

**LIEU :** Six hôpitaux et une salle d'urgence autonome d'Edmonton, en Alberta.

**PARTICIPANTS :** La présente étude incluait 2 354 patients faisant partie des catégories de risque IV et V dont le diagnostic de pneumonie avait été posé par un urgentologue ou un interniste.

**MESURES :** Les symptômes, les signes et les résultats de laboratoire ainsi que les mesures d'issues de l'hospitalisation et de la mortalité.

**RÉSULTATS :** Dans l'ensemble du groupe à l'étude, 319 des patients (13,5 %) ont été traités en consultations externes. Les facteurs prédictifs d'hospitalisation étaient une pneumonie avérée ou possible d'après la radiographie thoracique lue par un radiologue, une atteinte fonctionnelle, une altération de l'état mental, l'abus d'alcool ou de drogues, un trouble psychiatrique, une numération globulaire anormale, une numération lymphocytaire anormale, une saturation en oxygène inférieure à 90 % et l'administration d'antibiotiques pendant la semaine précédant l'hospitalisation. L'hospitalisation était moins probable en présence de douleurs thoraciques. Seulement deux des 319 patients ont dû être hospitalisés par la suite (tous deux avaient une culture sanguine positive), et seulement deux sont décédés.

**CONCLUSIONS :** Un nombre substantiel de patients des catégories de risque IV et V peut être traité à domicile en toute sécurité. On traite des facteurs qui aident les cliniciens à sélectionner ce sous-groupe de patients.

patients receive one point per year of age, while female patients have 10 points subtracted from the total age points. Thus, it is usually elderly patients who are in risk classes IV and V.

In a prospective study of CAP (4), we noted that 316 of 2251 patients (14%) in classes IV and V were managed on an ambulatory basis. The present paper compares the two groups of patients and provides data that should allow physicians to manage some of their class IV and V patients in an ambulatory setting.

## PATIENTS AND METHODS

### Study sites

The present study involved all six hospitals and one clinic with an emergency room in the Edmonton, Alberta, area. There were two

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tertiary care hospitals, two hospitals that provided secondary and some tertiary care, and two community hospitals. The study was approved by the Research Ethics Committee at the University of Alberta, Edmonton, Alberta.

### Development of a pneumonia pathway

A multidisciplinary team developed a comprehensive pathway for the management of CAP (5). The pathway consisted of an admission guideline (5). In general, treatment on an outpatient basis was recommended for those in risk classes I to III and on an inpatient basis for those in classes IV and V; however, a note on each guideline indicated that physician judgment was to take precedence in the final decision as to site of care. In addition, medical staff were given preprinted orders covering the routine aspects of care, an algorithm for administration and discontinuation of supplemental oxygen and antimicrobial therapy (levofloxacin orally or cefuroxime plus azithromycin intravenously were the options provided), but other options were not prohibited. Reminders to medical staff regarding assessment of vaccination status for pneumococcal and influenza vaccines were provided, and a recommendation for administration of these vaccines, if indicated, was included in the order sheet. In addition, counselling and literature regarding cessation of smoking were made available to those who were tobacco smokers.

The inpatient components of the pathway (6-8) are not detailed here because they are not pertinent to the present study. A follow-up phone call was made to patients who were discharged from the emergency department within 72 h of discharge.

### Pneumonia definition

A diagnosis of pneumonia was defined as two or more symptoms or signs of CAP (cough [productive or nonproductive], pleuritic chest pain, shortness of breath, temperature higher than 38°C, and crackles or bronchial breathing on auscultation) plus radiographic evidence of pneumonia as interpreted by the emergency room physician or internal medicine consultant. Patients were excluded from the pathway if they required admission to intensive care from the emergency room, or were thought to have aspiration pneumonia (defined as pulmonary opacities with recent loss of consciousness, vomiting or observation of respiratory distress within 30 min of feeding), tuberculosis or cystic fibrosis. Pregnant and nursing mothers and immunosuppressed patients (greater than 10 mg prednisone per day for more than one month or other immunosuppressive drugs) were also excluded. Those with HIV infection were excluded if their CD<sub>4</sub> counts were less than 250/mm<sup>3</sup>. During the second year of the study, patients with aspiration pneumonia were included (during the first year of the study the authors could not agree on a therapeutic regimen for patients with aspiration pneumonia). All patients with aspiration pneumonia were admitted.

### Data analysis

For analyses of data, SPSS version 12.0 was used (SPSS Inc, USA). Predisposing factors, clinical, laboratory and radiological findings, and mortality in ambulatory and admitted patients were compared using a univariate model. The predictors with  $P < 0.10$  in the univariate analysis were used in the multivariate analysis. Backward selection with the entry probability of 0.05 and removal probability of 0.1 were used to select the final model. The Hosmer-Lemeshow lack-of-fit test was used to evaluate the adequacy of the logistic regression models.

## RESULTS

Three hundred nineteen of the 2354 patients in risk groups IV and V (13.5%) were treated as outpatients. The characteristics of the ambulatory and hospitalized patients are shown in Table 1. Male patients predominated among class IV and V patients treated on an ambulatory basis (233 of 316 patients [73.7%]). The admission rates of class IV and V patients varied by site, from 83.2% to 89.8%. Site G had outpatient facilities only, and patients from that site who required admission were transferred to one of the other sites. It is noteworthy that the patients' residence before admission seemed to influence the admission decision, in that 82.5% of those who were living at home were admitted, while 100% of those who were living in a chronic care facility were admitted. Not unexpectedly, all eight homeless persons and seven persons residing in jail were admitted. Those who were discharged from the emergency department were less likely to have definite pneumonia on chest radiograph (as read by a radiologist) (37% versus 51.4% for the admitted group). Other key differences were: 65.5% of the ambulatory group was fully functional, compared with 44% of the admitted group; 9% of the ambulatory group was in class V, compared with 36% of the admitted group; and aspiration pneumonia was more common in the admitted group. Only 0.6% of the ambulatory patients died, compared with 13.8% of the hospitalized patients.

Table 2 shows the percentage of outpatients and inpatients with selected symptoms.

The objectively measured physiological parameters of temperature, respiratory rate and pulse rate were all higher in the admitted group. Table 3 gives vital signs and laboratory data for the two groups of patients expressed as the percentage with an abnormal value. It is noteworthy that oxygen saturation was less than 90% in 25% of the outpatients and 57.6% of the inpatients, and that 46.8% and 59%, respectively, had abnormal urea levels. The potassium level was abnormal in 15.6% of outpatients and 21.6% of inpatients. Table 4 shows the number and types of comorbidities in each group. Nineteen per cent of the outpatients and 39.4% of the inpatients had three or more comorbidities. In general, a much higher percentage of the inpatients had any of the indicated comorbidities than the outpatients.

Table 5 gives the blood culture results for both groups. Only 22% of the outpatients and 68% of the inpatients had these tests completed. The positivity rates were 2.8% and 7.9%, respectively. Only two of the outpatients had positive blood cultures – one for *Streptococcus pneumoniae* and the other for *Staphylococcus aureus*. Both were subsequently admitted. Thirty-nine per cent of the 105 isolates from the inpatient group were positive for *S pneumoniae*. It is interesting to note that *S aureus* accounted for 17% and *Escherichia coli* for 16% of the isolates. Fifteen other micro-organisms made up the remaining 27.6% of isolates.

The results of the multivariate analysis of the factors predictive of admission are given in Table 6. The following factors were independently predictive of admission: definite or possible pneumonia on chest radiograph as read by a radiologist, functional impairment, altered mental status, substance abuse, psychiatric disorder, abnormal white blood cell count, abnormal lymphocyte count, oxygen saturation less than 90% and antibiotic administration in the week before admission. If chest pain was present, admission was less likely. Follow-up of the outpatients revealed that only two died.

**TABLE 1**  
A comparison of the single-visit outpatient and admitted community-acquired pneumonia populations in risk classes IV and V

|  | Outpatients, n=319 | Inpatients, n=1935 | P      |
|--|--------------------|--------------------|--------|
| Sex, n (%)                                   |                    |                    |        |
| Male   | 233 (17.6)         | 1089 (82.4)        | <0.001 |
| Female                                       | 83 (8.9)           | 846 (91.1)         |        |
| Total  | 316                | 1935               |        |
| Age, years*                                  | 76.8±10.9          | 78.1±11.8          | 0.068  |
| Site, n (%)                                  |                    |                    |        |
| A  | 72 (10.2)          | 636 (89.8)         | <0.001 |
| B  | 51 (10.8)          | 421 (89.2)         |        |
| C  | 44 (14.7)          | 255 (85.3)         |        |
| D  | 59 (15.7)          | 317 (84.3)         |        |
| E  | 15 (13.3)          | 98 (86.7)          |        |
| F  | 42 (16.8)          | 208 (83.2)         |        |
| G  | 36 (100.0)         |                    |        |
| Total  | 319                | 1935               |        |
| Smoking status, n (%)                        |                    |                    |        |
| Smoker                                       | 38 (10.3)          | 332 (89.7)         | 0.007  |
| Nonsmoker                                    | 32 (5.3)           | 577 (94.7)         |        |
| Ex-smoker                                    | 50 (6.2)           | 755 (93.8)         |        |
| Total  | 120                | 1664               |        |
| Residence on admission, n (%)                |                    |                    |        |
| Home   | 294 (92.1)         | 1385 (71.5)        | <0.001 |
| Lodge/group home                             | 17 (7.9)           | 235 (12.4)         |        |
| Subacute care facility                       | 0                  | 14 (0.7)           |        |
| Continuing care facility                     | 0                  | 275 (14.2)         |        |
| Shelter                                      | 0                  | 4 (0.2)            |        |
| Jail   | 0                  | 7 (0.35)           |        |
| Homeless                                     | 0                  | 7 (100.0)          |        |
| Total  | 311                | 1927               |        |
| Discharge destination, n (%)                 |                    |                    |        |
| Home with no assistance required             | 275 (32.4)         | 574 (67.6)         | <0.001 |
| Home with home care                          | 44 (13.7)          | 534 (92.4)         |        |
| Continuing care facility                     | 0                  | 284 (100.0)        |        |
| Subacute                                     | 0                  | 90 (100.0)         |        |
| Rehabilitation facility                      | 0                  | 28 (100.0)         |        |
| Geriatric facility                           | 0                  | 21 (100.0)         |        |
| Other acute care facility in region          | 0                  | 40 (100.0)         |        |
| Other acute care facility out of region      | 0                  | 34 (100.0)         |        |
| Transfer within facility                     | 0                  | 4 (100.0)          |        |
| Shelter                                      | 0                  | 2 (100.0)          |        |
| Other  | 0                  | 87 (100.0)         |        |
| Total  | 319                | 1698 <sup>†</sup>  |        |
| Discharge, home care, n (%)                  |                    |                    |        |
| Nursing                                      | 22                 | 367                |        |
| Respiratory                                  | 28                 | 231                |        |
| Physiotherapy                                | 0                  | 24                 |        |
| Occupational therapy (ADLs, equipment setup) | 0                  | 64                 |        |
| Home intravenous therapy                     | 1                  |                    |        |

Continued in next column

**TABLE 1 – CONTINUED**  
A comparison of the single-visit outpatient and admitted community-acquired pneumonia populations in risk classes IV and V

|  | Outpatients, n=319 | Inpatients, n=1935 | P      |
|--|--------------------|--------------------|--------|
| Does the subject have x-ray confirming CAP pneumonia (ie, opacity compatible with pneumonia)?, n (%) |                    |                    |        |
| Yes  | 117 (36.9)         | 987 (51.4)         | <0.001 |
| No   | 146 (46.1)         | 555 (28.9)         |        |
| Possible   | 45 (14.1)          | 364 (18.9)         |        |
| No x-ray report available  | 9 (2.8)            | 14 (0.7)           |        |
| Total  | 317                | 1920 <sup>‡</sup>  |        |
| Nutritional status (weight loss >5% of body weight), n (%)   |                    |                    |        |
| Yes  | 1 (1.1)            | 184 (10.9)         | 0.003  |
| No   | 90 (98.9)          | 1499 (89.1)        |        |
| Total  | 91                 | 1683               |        |
| Functional status, n (%)   |                    |                    |        |
| Walking with no problems   | 209 (65.5)         | 851 (46.6)         | <0.001 |
| Walking with assistance (cane, walker, person assisted)  | 35 (10.9)          | 727 (39.8)         |        |
| Prosthesis   |                    | 9 (0.4)            |        |
| Bedridden  | 6 (1.8)            | 73 (4.0)           |        |
| Wheelchair bound   | 8 (2.5)            | 163 (8.9)          |        |
| Total  |                    | 1823 <sup>§</sup>  |        |
| Risk class   |                    |                    |        |
| IV   | 290 (90.9)         | 1252 (64.7)        | <0.001 |
| V  | 29 (9.1)           | 683 (35.3)         |        |
| Total  | 319                | 1935               |        |
| Length of stay, days*  |                    | 12.6±13.4          |        |
| Hours from presentation to ER till given first dose of antibiotic*                                   | 4.5±3.6            | 8.7±14.8           | <0.001 |
| Risk score*  | 108.6±15.4         | 124.0±24.4         | <0.001 |

\*Mean ± SD; <sup>†</sup>Data excluded inpatients who died or remained in the hospital; <sup>‡</sup>X-ray reports for 15 inpatients were missing; <sup>§</sup>Data for 112 inpatients were not recorded. ADLs Activities of daily living; CAP Community-acquired pneumonia; ER Emergency room

**TABLE 2**  
Comparisons of the symptoms and vital signs of single-visit outpatient and admitted community-acquired pneumonia populations in risk classes IV and V

|                                | Outpatients, n=319 | Inpatients, n=1935 | P      |
|--------------------------------|--------------------|--------------------|--------|
| Symptom, n (%)                 |                    |                    |        |
| Fever                          | 102 (31.9)         | 758 (39.1)         | 0.014  |
| Chest pain                     | 90 (28.2)          | 327 (16.8)         | <0.001 |
| Shortness of breath            | 199 (62.3)         | 1371 (70.9)        | 0.002  |
| Cough                          | 235 (73.6)         | 1312 (67)          | 0.036  |
| Altered mental state           | 19 (5.9)           | 385 (19.8)         | <0.001 |
| Diarrhea                       | 4 (1.3)            | 94 (4.8)           | 0.003  |
| Temperature*, °C               | 37.0±0.9           | 37.3±1.1           | <0.001 |
| Pulse*, beats/min              | 88.8±21.8          | 100.5±22.8         | <0.001 |
| Respiratory rate*, breaths/min | 24.6±6.6           | 27.6±8.4           | <0.001 |

\*Mean ± SD

**TABLE 3**  
Comparisons of abnormal vital signs and laboratory values for single-visit community-acquired pneumonia outpatients and inpatients in risk classes IV and V

|  | Outpatients<br>n (%) | Inpatients<br>n (%) | P      | Normal<br>range            |
|--|----------------------|---------------------|--------|----------------------------|
| Temperature, °C  |                      |                     |        |                            |
| Abnormal   | 57 (18.3)            | 580 (30.3)          | <0.001 | 35.5–38                    |
| Total  | 310                  | 1912                |        |                            |
| Pulse, beats/min   |                      |                     |        |                            |
| Abnormal   | 60 (18.9)            | 611 (31.6)          | <0.001 | 55–110                     |
| Total  | 316                  | 1930                |        |                            |
| Respiratory rate, breaths/min                              |                      |                     |        |                            |
| Abnormal   | 113 (36.2)           | 991 (54)            | <0.001 | 16–24                      |
| Total  | 312                  | 1883                |        |                            |
| Oxygen saturation<br>(by pulse oximetry), %                |                      |                     |        |                            |
| Abnormal   | 52 (17.1)            | 645 (34.5)          | <0.001 | ≥90                        |
| Total  | 304                  | 1869                |        |                            |
| Oxygen saturation on<br>room air (by pulse<br>oximetry), % |                      |                     |        |                            |
| Abnormal   | 45 (8.3)             | 499 (49)            | <0.001 | ≥90                        |
| Total  | 227 (18.4)           | 1010                |        |                            |
| Oxygen saturation (blood gas), %                           |                      |                     |        |                            |
| Abnormal   | 26 (25.2)            | 547 (43.7)          | 0.001  | ≥90                        |
| Total  | 103                  | 1297                |        |                            |
| Oxygen saturation on room air<br>(blood gas), %            |                      |                     |        |                            |
| Abnormal   | 20 (25.6)            | 416 (57.6)          | <0.001 | ≥90                        |
| Total  | 78                   | 721                 |        |                            |
| White blood cell, ×10 <sup>9</sup> /L                      |                      |                     |        |                            |
| Abnormal   | 118 (41.6)           | 1112 (58.1)         | <0.001 | 4.0–11.0                   |
| Total  | 283                  | 1912                |        |                            |
| Neutrophils, ×10 <sup>9</sup> /L                           |                      |                     |        |                            |
| Abnormal   | 146 (53.4)           | 1222 (65.2)         | <0.001 | 1.8–7.5                    |
| Total  | 279                  | 1873                |        |                            |
| Lymphocytes, ×10 <sup>9</sup> /L                           |                      |                     |        |                            |
| Abnormal   | 121 (43.5)           | 1084 (58.2)         | <0.001 | 1.0–4.5                    |
| Total  | 278                  | 1861                |        |                            |
| Blood urea nitrogen, mmol/L                                |                      |                     |        |                            |
| Abnormal   | 110 (46.8)           | 1018 (59.1)         | <0.001 | 2.5–8.0                    |
| Total  | 235                  | 1722                |        |                            |
| Creatine phosphokinase, U/L                                |                      |                     |        |                            |
| Abnormal   | 14 (10.1)            | 198 (19.2)          | 0.009  | Male: <180<br>Female: <150 |
| Total  | 138                  | 1026                |        |                            |
| Albumin, g/L   |                      |                     |        |                            |
| Abnormal   | 6 (31.5)             | 281 (63)            | 0.006  | 35–50                      |
| Total  | 19                   | 446                 |        |                            |
| Potassium, mmol/L  |                      |                     |        |                            |
| Abnormal   | 42 (15.6)            | 409 (21.6)          | 0.022  | 3.5–5.0                    |
| Total  | 269                  | 1885                |        |                            |
| Glucose, mmol/L  |                      |                     |        |                            |
| Abnormal   | 23 (9)               | 251 (14.4)          | 0.025  | 3.3–11.1                   |
| Total  | 250                  | 1741                |        |                            |

## DISCUSSION

Just over 13% of the patients in risk classes IV and V were treated as outpatients. In the original study (3) describing this severity of illness scoring system for CAP, only 41 of

**TABLE 4**  
Comparisons of comorbid illnesses between the single-visit outpatient and admitted community-acquired pneumonia population in risk classes IV and V

|                               | Outpatients, n=319<br>n (%) | Inpatients, n=1935<br>n (%) | P      |
|-------------------------------|-----------------------------|-----------------------------|--------|
| Total number of comorbidities |                             |                             |        |
| 0                             | 46 (14.4)                   | 101 (5.2)                   | <0.001 |
| 1                             | 103 (32.4)                  | 453 (23.4)                  |        |
| 2                             | 108 (33.8)                  | 599 (30.9)                  |        |
| 3                             | 44 (13.7)                   | 478 (24.7)                  |        |
| 4                             | 17 (5.3)                    | 203 (10.4)                  |        |
| 5                             | 1 (0.3)                     | 78 (4.0)                    |        |
| 6                             | 0                           | 20 (1)                      |        |
| 7                             | 0                           | 1                           |        |
| 8                             | 0                           | 2                           |        |
| Total                         | 319                         | 1935                        |        |
| Comorbidities                 |                             |                             |        |
| COPD                          | 77 (24.1)                   | 739 (38.1)                  | <0.001 |
| Substance abuse               | 4 (1)                       | 112 (5.7)                   | 0.001  |
| Alcohol abuse                 | 4 (1)                       | 98 (5.0)                    | 0.002  |
| Psychiatric disorder          | 9 (3.1)                     | 280 (14.4)                  | <0.001 |
| Stroke                        | 31 (9.3)                    | 301 (15.5)                  | 0.006  |
| Heart disease                 | 159 (12.2)                  | 1142 (59)                   | 0.002  |
| Renal disease                 | 39 (8.5)                    | 420 (21.7)                  | <0.001 |
| Neoplastic disease            | 66 (20.6)                   | 249 (12.8)                  | <0.001 |
| Cerebrovascular disease       | 25 (7.8)                    | 238 (12.2)                  | 0.021  |
| Dementia                      | 5 (1.5)                     | 231 (11.9)                  | <0.001 |
| Seizures                      | 3 (0.9)                     | 79 (4.1)                    | 0.005  |

*COPD Chronic obstructive pulmonary disease*

2287 patients (1.8%) in risk classes IV and V were treated as outpatients. However, the Fine et al (3) study differed from the current study in that only patients with radiographs read by a radiologist were enrolled. In our study, only 50% of the group treated as outpatients had radiologist-confirmed pneumonia. However, even if one adjusts for this there are still at least three times as many patients treated as outpatients in these risk groups than in the original study. It is noteworthy that in a randomized trial of a critical pathway for the treatment of pneumonia conducted at 19 hospitals in Canada from January to July 1998 (4), 87% of the patients in risk classes IV and V in the intervention arm, and 88% in the conventional treatment arm were admitted to hospital – values identical to those in the current study.

Our study also provides information as to which patients in risk classes IV and V are likely to do well with treatment on an ambulatory basis – patients who are fully functional, mentally alert, not hypoxemic, not substance abusers, do not have a concomitant psychiatric diagnosis, have normal total white blood cell and lymphocyte counts and normal respiratory rates, and have not received antibiotics in the past week. In a detailed analysis of factors that predicted mortality in the entire study population requiring admission to hospital, we noted that some of the factors that were predictive of admission in the class IV and V patients (in addition to being in one or the other of these two risk classes) were predictive of mortality (4). These included functional status, abnormal lymphocyte count and substance abuse, in addition to age and risk score.

We also noted that 13.7% of those treated on an ambulatory basis required home care. This has the obvious implication



**TABLE 5**  
Comparisons of blood culture results between single-visit outpatient and admitted community-acquired pneumonia population in risk classes IV and V

|   | Outpatient, n=319 | Inpatient, n=1935 | P      |
|---|-------------------|-------------------|--------|
| Blood culture done, n (%)                                       |                   |                   |        |
| Yes   | 70 (21.9)         | 1319 (68.2)       | <0.001 |
| Total   | 319               | 1933              |        |
| Blood culture obtained, n (%)                                   |                   |                   |        |
| Before antibiotic therapy                                       | 57 (81.4)         | 901 (64.5)        | 0.008  |
| After antibiotic therapy  | 13                | 411               |        |
| Blood culture, n (%)  |                   |                   |        |
| Positive  | 2 (2.8)           | 105 (7.9)         | 0.119  |
| Negative  | 68 (91.2)         | 1214 (92.1)       |        |
| Total   | 70 (5.0)          | 1319              |        |
| Micro-organism isolated, n (%)                                  |                   |                   |        |
| <i>Streptococcus pneumoniae</i>                                 | 1                 | 41 (39)           |        |
| <i>Staphylococcus aureus</i>                                    | 1                 | 18 (17.1)         |        |
| <i>Hemophilus influenzae</i>                                    |                   | 1 (1)             |        |
| <i>Escherichia coli</i>   |                   | 17 (16.1)         |        |
| Other   |                   | 29 (27.6)         |        |
| Other micro-organism isolated, n                                |                   |                   |        |
| <i>Abiotrophia species</i>                                      |                   | 1                 |        |
| <i>Clostridium clostridioforme</i>                              |                   | 1                 |        |
| <i>Enterococcus faecalis</i>                                    |                   | 3                 |        |
| <i>Fusobacterium nucleatum</i>                                  |                   | 1                 |        |
| <i>Actinomyces viscosus</i>                                     |                   | 1                 |        |
| <i>Klebsiella oxytoca</i>                                       |                   | 1                 |        |
| <i>Klebsiella pneumoniae</i>                                    |                   | 4                 |        |
| <i>Klebsiella pneumoniae</i> and<br><i>Enterococcus species</i> |                   | 1                 |        |
| <i>Proteus mirabilis</i>  |                   | 2                 |        |
| <i>Pseudomonas aeruginosa</i>                                   |                   | 3                 |        |
| <i>Streptococcus anginosus</i> group                            |                   | 1                 |        |
| <i>Streptococcus anginosus</i>                                  |                   | 2                 |        |
| <i>Streptococcus bovis</i>                                      |                   | 1                 |        |
| <i>Streptococcus pyogenes</i>                                   |                   | 4                 |        |
| <i>Streptococcus viridans</i>                                   |                   | 3                 |        |

that such services have to be available to care for these patients.

Only 22% of the outpatients had blood cultures, and of these, only two patients had a positive result – one with *S pneumoniae* and one with *S aureus*. Both these patients were admitted (the only ones who required subsequent admission).

Our study has some limitations. Our follow-up consisted of a phone call at 72 h after discharge and checking hospital records for subsequent admission. Thus, we may have missed patients who were admitted to hospitals outside our area following discharge from the emergency department, and we also could have underestimated the number of patients who died for the same reasons.

### CONCLUSIONS

We have shown that a significant percentage of patients in risk classes IV and V can be safely treated at home. In addition, we have elucidated factors which will help the clinician in selecting the subset of patients in these two risk classes who can be sent home.

**TABLE 6**  
Logistic regression model predicting admission of single-visit community-acquired pneumonia patients who were in risk classes IV and V

|  | P      | OR   | 95% CI for OR |
|--|--------|------|---------------|
| X-ray-confirmed pneumonia                                    | 0.010  |      |               |
| Yes versus no  | 0.021  | 1.55 | 1.07–2.26     |
| Possible versus no   | 0.006  | 2.00 | 1.22–3.29     |
| Functional status  | <0.001 |      |               |
| Walking with assistance<br>versus no problems                | <0.001 | 4.79 | 3.10–7.42     |
| Prosthesis versus no problems                                | 0.999  |      | 0.00          |
| Bedridden versus no problems                                 | 0.671  | 1.25 | 0.45–3.46     |
| Wheelchair bound<br>versus no problems                       | 0.011  | 3.16 | 1.30–7.66     |
| Chest pain   | 0.001  | 0.53 | 0.36–0.77     |
| Altered mental state   | <0.001 | 4.56 | 2.23–9.33     |
| Substance abuse  | 0.008  | 4.27 | 1.45–12.56    |
| Psychiatric disorder   | <0.001 | 5.58 | 2.18–14.26    |
| Abnormal white blood cell count                              | <0.001 | 1.86 | 1.32–2.63     |
| Abnormal lymphocytes   | 0.001  | 1.74 | 1.24–2.44     |
| Respiratory rate <16 or<br>>24 breaths/min                   | <0.001 | 2.05 | 1.45–2.92     |
| Oxygen saturation <90%                                       | <0.001 | 2.15 | 1.41–3.28     |
| Antibiotics given before<br>admission (within the past week) | 0.003  | 1.99 | 1.27–3.12     |

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### REFERENCES

- Simpson SH, Marrie TJ, Majumdar SR. Do guidelines guide pneumonia practice? A systematic review of interventions and barriers to best practice in the management of community-acquired pneumonia. *Respir Care Clin N Am* 2005;11:1-13.
- Basi SK, Marrie TJ, Huang JQ, Majumdar SR. Patients admitted to hospital with suspected pneumonia and normal chest radiographs: epidemiology, microbiology, and outcomes. *Am J Med* 2004;117:305-11.
- Fine MJ, Auble TE, Yealy DM, et al. A prediction rule to identify low risk patients with community-acquired pneumonia. *N Engl J Med* 1997;336:243-50.
- Marrie TJ, Wu L. Factors influencing in-hospital mortality in community-acquired pneumonia: A prospective study of patients not initially admitted to the ICU. *Chest* 2005;127:1260-70.
- Marrie TJ, Michalyk D, Mann P, and the Community-Acquired Pneumonia Critical Pathway Team. A critical pathway for treating community-acquired pneumonia. *Can J CME* 2001;13:43-57.
- Halm E, Fine MJ, Marrie TJ, et al. Time of clinical stability in patients hospitalized with community-acquired pneumonia: Implications for practice guidelines. *JAMA* 1998;279:1452-7.
- Podsiadlo D, Richardson S. The timed "Up & Go": A test of basic functional mobility for frail elderly persons. *J Am Geriatr Soc* 1991;39:142-8.
- Crum RM, Anthony JC, Bassett SS, Folstein MF. Population-based norms for the mini-mental state examination by age and educational level. *JAMA* 1993;269:2386-91.