Rebounds after discharge from the emergency department for community-acquired pneumonia: focus on the usefulness of severity scoring systems

Rodolfo Ferrari1, Pierluigi Viale2, Paolo Muratori3, Fabrizio Giostra1,4, Daniela Agostinelli1,5, Roberto Lazzari1,6, Riccardo Voza1,7, Mario Cavazza1

1 U.O. Medicina d’Urgenza e Pronto Soccorso, Policlinico Sant’Orsola-Malpighi, Dipartimento dell’Emergenza-Urgenza, Azienda Ospedaliero-Universitaria di Bologna, Italy; 2 U.O. Malattie Infettive, Policlinico Sant’Orsola-Malpighi, Dipartimento delle Insufficienze d’Organo e dei Trapianti, Università degli Studi di Bologna - Alma Mater Studiorum, Italy; 3 P.D.A. Medicina interna a supporto del Dipartimento dell’Emergenza, Dipartimento dell’Emergenza-Urgenza, Università degli Studi di Bologna - Alma Mater Studiorum, Italy; 4 U.O. Medicina e Chirurgia d’Accettazione e d’Urgenza, Azienda Sanitaria Unica Regionale - Marche, Area Vasta n. 4, Fermo, Italy; 5 U.O. Medicina Interna, Policlinico Sant’Orsola-Malpighi, Dipartimento Medico della Continuità Assistenziale e delle Disabilità. Università degli Studi di Bologna - Alma Mater Studiorum, Italy; 6 Servicio de Urgencias, Hospital de la Santa Creu i Sant Pau. Barcelona, Catalonia, Spain; 7 U.O. Pronto Soccorso ed Emergenza Territoriale Area Nord, Dipartimento Emergenza, Azienda Unità Sanitaria Locale di Bologna, Italy

Summary. Background: Community-acquired pneumonia (CAP) is common cause of hospital admission and leading cause of morbidity and mortality. Severity scoring systems are used to predict risk profile, outcome and mortality, and to help decisions about management strategies. Aim of the work and Methods: To critically analyze pneumonia “rebound” cases, once discharged from the emergency department (ED) and afterwards admitted. We conducted an observational clinical study in the acute setting of a university teaching hospital, prospectively analyzing, in a 1 year period, demographic, medical, clinical and laboratory data, and the outcome. Results: 249 patients were discharged home with diagnosis of CAP; 80 cases (32.1%) resulted in the high-intermediate risk class according to CURB-65 or CRB-65. Twelve patients (4.8%) presented to the ED twice and were then admitted. At their first visit 5 were in the high-intermediate risk group; just 4 of them were in the non-low risk group at the time of their admission. The rebound cohort showed some peculiar abnormalities in laboratory parameters (coagulation and renal function) and severe chest X-rays characteristics. None died in 30 days. Conclusions: The power of CURB-65 to correctly predict mortality for CAP patients discharged home from the ED is not confirmed by our results; careful clinical judgement seems to be irreplaceable in the management process. Many patients with a high-intermediate risk according to CURB-65 can be safely treated as outpatients, according to adequate welfare conditions; we identified a subgroup of cases that should worth a special attention and, therefore, a brief observation period in the ED before the final decision to safely discharge or admit. (www.actabiomedica.it)

Key words: community-acquired pneumonia, severity scoring systems, rebounds, CURB-65 score, CRB-65 score, emergency department, clinical judgment, risk stratification, admit versus discharge, continuity of care

List of abbreviations

| Abbreviation | Description |
|--------------|-------------|
| ABG          | Arterial Blood Gas |
| ATS          | American Thoracic Society |
| BP           | Blood Pressure (mm Hg) |
| bpm          | breaths per minute |
| BTS          | British Thoracic Society |
| CAP          | Community-acquired Pneumonia |
| CRB-65       | Confusion, Respiratory Rate, Blood Pressure, Age |
| CURB-65      | Confusion, Urea, Respiratory Rate, Blood Pressure, Age |
| DBP          | Diastolic Blood Pressure (mm Hg) |
| ED           | Emergency Department |
Introduction and aim of the study

Community-acquired pneumonia (CAP) is the most frequent severe infection in medical practice, a common cause of hospital admission, and a leading cause of increased morbidity and mortality (1-5).

The right management of CAP in the emergency department (ED) is essential to ensure optimal management for each patient, and also for the proper use of hospital resources. Despite a significant body of relevant literature, several doubts remain, namely related to the optimal definition of clinical severity, most useful criteria for appropriate patient allocation, the value of immediate microbiological diagnosis, and proper criteria for treatment choice (5-11).

In the everyday real-life of bedside practice, emergency physicians (EPs) face the crucial challenge to assess the optimal initial management and adequate monitoring of patients with CAP, to identify those at high or intermediate or low risk, to pick out eligible patients for a safe and effective out-of-hospital (OOH) treatment in the community, ensuring a positive impact on quality of health care, quality of life, and individual satisfaction. To get to this point it is necessary to carefully evaluate clinical factors, but also welfare conditions and subjective aspects that are neither predictable “a priori”, nor easy to identify in the pressing setting of the ED. Mortality, hospital readmissions and dissatisfaction with care are the recognized indicators for failure in this multifaceted decision process.

Severity scoring systems (SSSs) are widely used to predict risk profile, outcome and mortality, and to help decisions about treatment and management strategies (12-27). The most remarkable scales in common clinical use for CAP in the ED are CURB-65 and CRB-65 (12-14) which showed some limitations but also high specificity and a high positive predictive value. CURB-65 prognostic rule was developed in 2003 (14), starting from a British Thoracic Society (BTS) study conducted in 1996 (13), and further moving from the m-BTS rule described in 1987 (12) concerning a severity assessment based on few variables which can easily be obtained at presentation or admission to hospital, and strongly associated with death from CAP. Among others, Pneumonia Severity Index (PSI) (15) is a well validated and widely adopted SSS indeed, but it is known to be an unsuitable tool for the ED scenario for the acute management of CAP, and mostly for outpatients (28, 29): it is neither easy to remember nor to compute, it is time consuming because it consists of 20 items, invasive tests as arterial blood gas analysis can often be required.

Many lights and shadows, and pros and cons, have been debated in last twenty years about the usefulness of SSSs for CAP (30-34), mainly in the emergency setting (5, 35-45), due to the little help coming from evidence based medicine in this scenario. The prognostic accuracy of SSSs is well established in hospitalized patients, but much less is known about their use in out-patients (46, 47). However, admission rates for low risk patients with CAP are known to be as high as 60% (48-50), which calls into question the ability of SSS to correctly predict the need for hospitalization, and, on the other hand, the accuracy of EPs initial judgment in making the appropriate admission disposition.

Premise of this work was to critically analyze “bounce back” cases: CAP patients who, at their first presentation to the ED, were discharged for outpatient management and subsequently rebounded to the ED and were then admitted for in-hospital treatment. These patients, taken as a whole, represent a critical point and a “failure” to be avoided, since any delay due to a wrong risk stratification could determine very bad prognostic consequences and worsen the outcome.
The aim of this study was then to evaluate the frequency and the impact of discharging from the ED non-low-risk patients with CAP, according to CURB-65 score (≥2) or CRB-65 score (≥1), the rate of return visits to the ED, the rate of rebound cases with subsequent admittance, and 30-day mortality.

We focused on return cases to determine the ability of SSSs to correctly and accurately predict outcome and mortality in patients discharged with main diagnosis of CAP in the ED. We then critically analyzed those cases in which the EP’s choice to discharge home a patient with CAP for OOH management and treatment disagreed with the high-intermediate (non-low) risk profile established by SSSs.

Materials and methods

We conducted an observational prospective clinical single-center study in the acute setting of the ED of a university teaching hospital (5), enrolling and following up every consecutively non-selected adult patient (aged ≥14 years) with CAP discharged home for OOH treatment.

Diagnosis of CAP was defined on the presence of new infiltrates on chest X-rays with physical findings and compatible history (5).

Cases satisfying diagnostic criteria for health-care acquired pneumonia (HCP) or ventilation-associated pneumonia (VAP) (51) were not included in the analysis.

CURB-65 and/or CRB-65 (table 1) were measured and recorded in every patient. Confusion was defined as new disorientation in person, space or time (14). Urea was tested as mg/dL, respiratory rate (RR) as breaths per minute (bpm), systolic blood pressure (SBP) and diastolic blood pressure (DBP) as mmHg.

We prospectively analyzed, in the 1 year period of our study (between April 20th 2013 and April 19th 2014), demographic, medical, clinical and laboratory data recorded in the ED, and the outcome (“rebounds” in 30 days). We then compared two study groups: “discharged and non-readmitted” versus “discharged and rebounded and then admitted”, including every rebound to our ED within 30 days of discharge from the ED itself because of CAP related unresolved problems.

Table 1. CURB-65 and CRB-65 severity scores for community-acquired pneumonia

| Clinical factor | Score |
|----------------|-------|
| C: Confusion    | 0-1   |
| U: Urea >43 mg/dL | 0-1   |
| R: Respiratory rate ≥30 breaths per minute | 0-1 |
| B: Systolic Blood pressure <90 mm Hg or Diastolic Blood pressure ≤60 mm Hg | 0-1 |
| 65: age ≥ 65 years | 0-1 |
| Total score     | Score |
| CURB-65         | 0-5   |
| CRB-65          | 0-4   |

The University Hospital database was then queried for length of stay and bed days in both the Intensive Care Unit (ICU), and/or High Medical Dependency Unit (HMDU), and/or regular ward for all patients subsequently admitted to the hospital.

Due to the limited number of cases “rebounced and admitted”, the comparison of categorical variables was performed using percentages; media, median, minimum and maximum were instead used for the comparison of continuous data.

Results

Two-hundred and forty-nine patients (media 0.68/day) were emergently evaluated and discharged home for OOH treatment with main diagnosis of CAP [in the same period approximately 817 subjects were admitted with the same diagnosis (52, 53)]; 169 (67.9%) cases resulted in the low-risk class according to CURB-65 or CRB-65 score, the remaining 80 (32.1%) were at high-intermediate risk.

The mean and median age were 42 and 44 years, respectively (range 15-92). One-hundred and thirty-three (53.4%) were female. One-hundred and fourteen patients (45.8%) had been visited by a physician after the debut of symptoms and before the presentation to the ED; 97 (39.0%) were already taking oral antibiotics when they first came to the ED, and 32 (12.9%) had been recommended for other treatment because of respiratory symptoms before presenting to the ED. For-
ty-five patients (18.1%) were sent to the ED following the recommendation by a primary care or a consulting physician, and 41 (16.5%) were transported to the ED by an ambulance. One-hundred and forty-six (58.6%) were discharged with recommendation to an antibiotic combination therapy, the remaining 103 (41.4%) with a single antimicrobial treatment. Twenty-four (9.6%) had an in-hospital follow up consultation planned in the next days at discharge from the ED.

Of 249 discharged patients, 228 (91.6%) didn't return to our ED for CAP related problems at 30 days, and 21 (8.4%) bounced back; of these last 21 individuals, 9 were discharged once again (3.6% of all, 42.9% of rebounded) to outpatient treatment, and the remaining 12 (4.8% of total, 57.1% of rebounded) were then admitted for in-hospital management at their second presentation to the ED.

The mean interval between the first and second presentation to the ED for return visits was 7 days (range 0-20, median 4); for “rebounded and then admitted” cases it was 4 days (range 0-4, median 2), respectively.

When looking at the differences, although the low number of cases in the return cases cohort, patients admitted after having been discharged showed some slight distinguishing features (Table 2) in laboratory parameters (in particular, abnormal coagulation and renal function) and peculiar severe chest X-rays characteristics (two or more infiltrates, bilateral infiltrates, lobar infiltrates, pleural effusion).

Admission to the ICU was never required for these patients, neither mechanical ventilation nor inotropic infusion was needed in the ED.

The mean in-hospital length of staying for rebounded and admitted patients was 9 days (range 3-15, median 8). None of them died in-hospital; they all were discharged home; they all were alive after 30 days.

The characteristics and parameters for comparison of the two study groups (discharged versus returned and admitted) are shown in detail in Table 2, 3, 4 and 5.

Urea was measured in 122 (49.0%) of all discharged patients, so CURB-65 score was not available in 51.0% cases; it was possible to assess CRB-65 for all 249 patients. Patients discharged and not rebounded in 30 days had urea measurement in 115 cases (48.5%), so it was possible for them to calculate both CRB-65 and CURB-65 score; rebounded and admitted had urea in 7 (58.3%) (Table 4 and 5).

Of all discharged patients with CAP, 80 (32.1%) were at “non-low” (high-intermediate) risk of mortality according to SSSs (CURB-65 ≥2 or CRB-65 ≥1). Five discharged patients even resulted in a high risk for mortality (CURB-65 = 3); 1 of them was rebounded and then admitted. In the non-low risk 80 patients group, just 5 (6.3%) were between those who bounced back and were then admitted.

Focusing on the group of 12 patients rebounded and then admitted, the trend of SSSs comparing first and second presentation to the ED is noteworthy (table 6): 7 of them (58.3%) were previously discharged with low risk profile according to SSS (CURB-65 <2 and CRB-65 <1) at their first presentation, the remaining 5 (41.7%) with non-low (high-intermediate) risk profile. At their second presentation 8 of 12 patients (66.7%) were at low risk, and 4 (33.3%) at non-low risk; in 4 cases SSS dropped 1 point, and in 1 case risk profile lowered (from intermediate to low); 3 of 4 patients with intermediate risk of mortality at second presentation were considered non-low because of CRB-65 = 1 just due to age ≥65 years.

Discussion and conclusions

Return visits of patients discharged from the ED usually represent a failure for EPs. Risk stratification for CAP in the ED represents a challenge: the decision to safely discharge home for OOH management needs both adequate clinical and welfare conditions (5, 31, 40, 41, 45, 47, 56-59).

Our results did not confirm the ability and strength of CURB-65 and CRB-65 to correctly predict mortality for CAP patients discharged home from the ED.

In this regard, it has to be stressed the original meaning of SSSs; in particular, CURB-65 was born as a score to focus on CAP adult patients admitted to in-hospital treatment, to analyze and define prognostic factors related to in-hospital mortality versus survival to discharge, to improve the prediction of mortality and the identification of patients requiring admission to ICU (13, 14). CURB-65 was not conceived
CAP discharge from ED: rebounds and scores

Table 2. Comparison of the two study groups (“simply discharged” versus “discharged, rebounded and then admitted”): media, median and range

|                      | Discharged and never admitted | Discharged, rebounded and then admitted |
|----------------------|-------------------------------|----------------------------------------|
|                      | Mean  | Median | Min  | Max  | Mean  | Median | Min  | Max  |
| Age (years)          | 43    | 42     | 15   | 94   | 60    | 59     | 40   | 83   |
| Time spent in the ED (hours:minutes) | 3:32  | 3:12   | 0:27 | 15:09| 4:26  | 4:25   | 1:07 | 8:02 |
| SBP (mm Hg)          | 125   | 120    | 90   | 200  | 130   | 120    | 110  | 180  |
| DBP (mm Hg)          | 75    | 78     | 60   | 100  | 79    | 80     | 70   | 100  |
| MBP (mm Hg)          | 92    | 92     | 70   | 133  | 96    | 93     | 83   | 127  |
| HR (ppm)             | 92    | 90     | 58   | 130  | 92    | 96     | 66   | 118  |
| RR (bpm)             | 14    | 14     | 12   | 30   | 15    | 15     | 12   | 30   |
| GCS                  | 15    | 15     | 15   | 15   | 15    | 15     | 14   | 15   |
| SpO₂ (%)             | 98    | 98     | 88   | 100  | 97    | 98     | 93   | 99   |
| Temperature (°C)     | 37,2  | 37,2   | 36.0 | 40.0 | 37.1  | 37.0   | 36.0 | 38.0 |
| White Blood Cells x10⁹/mm³ | 10,15 | 9,23   | 2,56 | 27,83| 10,44 | 8,55   | 4,33 | 18,13|
| Hemoglobin mg/dl     | 13,8  | 13,7   | 10,5 | 17,6 | 12,9  | 12,9   | 10,9 | 15,4 |
| Hematocrit %         | 40,1  | 40,0   | 30,2 | 48,8 | 38,1  | 39,4   | 32,7 | 42,7 |
| Platelets x10⁹/mm³   | 268   | 249    | 50   | 695  | 231   | 228    | 108  | 348  |
| Prothrombin Time - International Normalized Ratio | 1,15  | 1,07   | 1,00 | 2,71 | 1,67  | 1,31   | 1,15 | 2,09 |
| Activated Partial Thromboplastin Time ratio | 1,15  | 1,14   | 0,90 | 1,60 | 1,50  | 1,41   | 1,18 | 1,96 |
| Glucose mg/dl        | 106   | 102    | 65   | 193  | 130   | 126    | 92   | 168  |
| Urea mg/dl           | 32    | 29     | 5    | 184  | 65    | 37     | 18   | 194  |
| Creatinine mg/dl     | 0,86  | 0,82   | 0,50 | 3,60 | 1,11  | 1,01   | 0,56 | 2,05 |
| Sodium mEq/l         | 140   | 140    | 128  | 148  | 136   | 137    | 126  | 140  |
| Potassium mEq/l      | 4,2   | 4,1    | 3,1  | 6,5  | 4,5   | 4,3    | 3,5  | 6,6  |
| Chloride mEq/l       | 102   | 102    | 96   | 111  | 96    | 96     | 94   | 98   |
| Calcium mEq/l        | 9,0   | 9,0    | 7,7  | 10,4 | 9,1   | 9,2    | 8,6  | 9,6  |
| Protein              | 7,2   | 7,3    | 5,9  | 8,4  | 7,2   | 7,2    | 6,7  | 7,6  |
| Albumin              | 4,3   | 4,4    | 3,2  | 4,9  | 3,7   | 3,7    | 3,5  | 3,8  |
| Bilirubin mg/dl      | 0,5   | 0,5    | 0,2  | 2,0  | 1,0   | 0,9    | 0,3  | 1,9  |
| Aspartate (Glutamate - Oxaloacetate) Transaminase U/l | 27    | 21     | 10   | 91   | 18    | 19     | 9    | 27   |
| Alanine (Glutamate - Pyruvate) Transaminase U/l | 28    | 21     | 6    | 144  | 18    | 17     | 7    | 27   |
| Amylase              | 54    | 52     | 25   | 100  | 54    | 54     | 36   | 71   |
| Creatine Kinase U/l  | 126   | 83     | 17   | 715  | 98    | 59     | 30   | 205  |
| Cholinesterase       | 7,3   | 7,3    | 2,8  | 10   | 6,2   | 4,3    | 3,3  | 11   |
| C Reactive Protein mg/l | 7,48  | 4,51   | 0,05 | 40,34| 9,76  | 6,52   | 0,46 | 33,36|

or validated to identify patients at low risk of mortality who might be suitable for early hospital discharge and OOH management, since the final decision on the appropriate discharge of a patient depends on clinical judgment, on social and family contexts, and not merely on the application of a score.

About one third (80 cases; 32.1%) of patients discharged from our ED with CAP had an intermediate/ high mortality risk according to SSSs (CURB-65 ≥2 or CRB-65 ≥1); following the recommendations coming from main SSSs, all of them should have been hospitalized for supervised treatment or even urgent admission; moreover, some of them (5 cases) should also have been evaluated and considered suitable for the admission to the ICU (in high risk cases, CURB-65 ≥3) (4, 6, 14). In facts, in our series, 5 discharged patients resulted in a high risk for mortality because of a CURB-65 score = 3, but only 1 of them bounced back and was then admitted. Moreover, no patient with CAP discharged for OOH treatment died in the 30 days follow up period.

In the everyday real-life of the ED, very often clinical judgment and score enforcement disagree; our experience show that prioritizing the weighted clinical decision, even if against prediction rules, does not increase neither the risk of mortality nor the rate of ad-
verse events in CAP outpatients managed and treated OOH.

Evidence from many studies clearly demonstrated how SSSs are of limited usefulness for deciding about CAP patients hospitalization: clinical judgement and the whole “holistic” evaluation of technical and non-technical aspects (as frailty, comorbidities, welfare conditions, characteristics of continuity of care in the

### Table 3. Comparison of the two study groups (“simply discharged” versus “discharged, rebounded and then admitted”): rates (%)

| Gender: Female | Discharged and never admitted | Discharged, rebounded and then admitted |
|----------------|-------------------------------|-----------------------------------------|
| Yes %          | No %                         | Yes %                                   | No %                                   |
| 57,8           | 42,2                         | 50,0                                    | 50,0                                   |

| Previous visit by primary care or consulting physician (because of new respiratory symptoms) | 45,1 | 54,9 | 58,3 | 41,7 |
|-----------------------------------------------------------------------------------------------|-----|-----|-----|-----|
| Already in antibiotic therapy at presentation to the ED | 39,1 | 60,9 | 41,7 | 58,3 |
| Other (then antibiotic) new treatment for respiratory symptoms | 13,1 | 86,9 | 8,3 | 91,7 |
| Presentation to the ED recommended by primary care or consulting physician | 18,1 | 81,9 | 16,7 | 83,3 |
| Carriage to the ED by ambulance service | 16,0 | 84,0 | 25,0 | 75,0 |
| Typical CAP clinical presentation | 82,7 | 17,3 | 83,3 | 16,7 |
| Dyspnoea | 14,8 | 85,2 | 16,7 | 83,3 |
| Kelly-Matthay scale >1 (52) | 0,0 | 100,0 | 8,3 | 91,7 |
| ABG performance rate | 6,3 | 93,7 | 8,3 | 91,7 |
| Multiple (>1) consolidations at chest radiograph | 8,9 | 91,1 | 0,0 | 100,0 |
| Bilateral shadowing at chest radiograph | 4,6 | 95,4 | 12,3 | 87,7 |
| Pleural effusion at chest radiograph | 6,3 | 93,7 | 33,3 | 66,7 |
| Recommended combination antibiotic home treatment at discharge | 58,6 | 41,4 | 58,3 | 41,7 |
| Ambulatory care follow-up planned after discharge from the ED | 8,4 | 91,6 | 33,3 | 66,7 |
| Rebound to the ED because of CAP related problems in 30 days | 3,8 | 96,2 | 100,0 | 0,0 |

### Table 4. Comparison of the two study groups (“simply discharged” versus “discharged, rebounded and then admitted”): CURB-65 and CRB-65 rates

| Total score | CURB-65 | CRB-65 |
|-------------|---------|--------|
| 0           | 70 (60,9 %) | 162 (68,4 %) |
| 1           | 25 (21,7 %) | 60 (25,3 %) |
| 2           | 16 (13,9 %) | 15 (6,3 %) |
| 3           | 4 (3,5 %) | 0 (0,0 %) |
| 4           | 0 (0,0 %) | 0 (0,0 %) |
| 5           | 0 (0,0 %) | 7 (58,3 %) |

| Total score | CURB-65 | CRB-65 |
|-------------|---------|--------|
| 0           | 2 (28,6 %) | 0 (0,0 %) |
| 1           | 2 (28,6 %) | 1 (14,3 %) |
| 2           | 2 (28,6 %) | 0 (0,0 %) |
| 3           | 0 (0,0 %) | 0 (0,0 %) |
| 4           | 7 (58,3 %) | 3 (25,0 %) |
| 5           | 2 (16,7 %) | 0 (0,0 %) |

### Table 5. Comparison of the two study groups (“simply discharged” versus “discharged, rebounded and then admitted”): CURB-65 and CRB-65 details

| point | Discharged and never admitted | Discharged, rebounded and then admitted |
|-------|------------------------------|-----------------------------------------|
|       | 0 %                          | 1 %                                     |
|       | 0 %                          | 1 %                                     |
| C: Confusion | 237 (100,0 %) | 0 (0,0 %) | 11 (91,7 %) | 1 (8,3 %) |
| U: Blood Urea nitrogen >43 mg/dL | 96 (83,5 %) | 19 (16,5 %) | 4 (57,1 %) | 3 (42,9 %) |
| R: Respiratory rate ≥30 breaths per minute | 202 (85,2 %) | 35 (14,8 %) | 10 (83,3 %) | 2 (16,7 %) |
| B: Systolic Blood pressure <90 mm Hg or diastolic Blood pressure ≤60 mm Hg | 216 (91,1 %) | 21 (8,9 %) | 12 (100,0 %) | 0 (0,0 %) |
| 65: age ≥65 years | 201 (84,8 %) | 36 (15,2 %) | 8 (66,7 %) | 4 (33,3 %) |
community, etc.) make the difference for real-life bedside decisions; several cases considered at low risk are still managed in-hospital because of a number of “good reasons” (5, 31-33, 40, 41, 52, 53).

Many patients with an intermediate-high risk according to SSSs can safely be treated as outpatients, when adequate welfare conditions are present. In this scenario, we identified a group of patients, in particular those with abnormal coagulation and impairment of renal function or chest X-rays complications (56, 60), deserving a brief intensive observation period (6 to 36 hours) in a Short Stay Unit (SSU) in the ED, to assess the effectiveness of therapy, to ascertain the maintenance of clinical stability, and to contact the General Practitioner (GP) before the final decision to safely discharge or admit (41, 49, 56, 58, 59).

Of course, in this cohort of acute CAP patients directed to OOH management by the EP, the impairment of both renal function tests and coagulation system were not due neither to sepsis nor septic shock, but rather to chronic diseases (such as chronic renal failure) and pharmacological therapy (such as warfarin).

Future large prospective studies are required to draw more definite conclusions, and to define which parameters, features and markers are needed to develop and validate a new or modified SSS, in order to increase the weight and value of some pivotal aspects in the “triage” process of CAP patients in the ED, leading to a better performance and discriminative capability to focus on the real need for hospitalization in every single patient.

Our study has some noticeable limitations: it’s a prospective study from a single-center, there is no standardized method of RR measurement, return visits after admission have not been considered, and the reasons of hospitalization were deduced from clinical records. The city of Bologna (Italy) has nearly 1 million resident inhabitants in the whole province area; the main town has just 2 public Hospitals with an ED, serving the population of 400 thousand people for adults acute medical care: the University Teaching Hospital on the eastern side (the one in which our study was performed), and the Trauma Centre in the western part: we can not rule out that some patients

| Table 6. Comparison of SSS at first and second presentation in “discharged, rebounded and then admitted” patients |
|---------------------------------------------------------------|
| Patient ID number | n 1 | n 2 | n 3 | n 4 | n 5 | n 6 | n 7 | n 8 | n 9 | n 10 | n 11 | n 12 |
| **First presentation** | | | | | | | | | | | | |
| CURB-65 score (1 point in C, U, R, B and/or 65) | 1 (R) | 3 (U, R, 65) | 1 (65) | 0 | 0 | 1 (U) | 0 | 0 | 2 (C, 65) | 0 | 2 (U, 65) |
| CRB-65 score (1 point in C, R, B and/or 65) | 1 (R) | 2 (R, 65) | 1 (65) | 0 | 0 | 0 | 0 | 0 | 2 (C, 65) | 0 | 1 (65) |
| Risk of mortality | non-low | non-low | non-low | low | low | low | low | low | non-low | low | non-low |
| **Second presentation** | | | | | | | | | | | | |
| CURB-65 score (1 point in C, U, R, B and/or 65) | 0 | 3 (U, R, 65) | 1 (65) | 0 | 0 | 0 | 0 | 0 | 0 | 1 (65) | 0 | 1 (65) |
| CRB-65 score (1 point in C, R, B and/or 65) | 0 | 2 (R, 65) | 1 (65) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 (65) | 0 | 1 (65) |
| Risk of mortality | low | non-low | non-low | low | low | low | low | low | low | non-low | low | non-low |
| Delta points (second presentation versus first) | -1 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | -1 | 0 | -1 |
| Delta risk of mortality (from first to second presentation) | = | = | = | = | = | = | = | = | = | = | = |

Delta risk of mortality from “non-low” to low
who have been discharged from our hospital bounced back to other hospitals, even if the regional organization of the Emergency Ambulance Service in our town makes it unlikely.

This work has also some newsworthy strengths: we prospectively and systematically studied a large sample of unselected consecutive patients during a 1 year ongoing and uninterrupted period; the site of the study was an “Internal Medicine” Emergency Department (University Hospital with separated triage for Pediatrics, Obstetrics, Ophthalmology and Orthopedics patients, non Trauma-Center). The majority of published experiences about CAP patients selected for OOH treatment starts up and moves from cases at low risk of death according to SSS, and then discharged home. Our study turns the point of view downside up: in fact we analyzed the real-life CAP cases discharged from the ED for outpatient management regardless of the degree of SSSs, we prospectively recorded their outcome, and then re-evaluate “ex post”, by an epicrisis, the decision process about site of treatment according to their risk of death early established by SSS at presentation to the ED. This was the first study to investigate discharge among non-low risk patients with CAP in the ED of a University Hospital referring to CURB-65 and CRB-65 scores; this should allow our results to be generalised even to other hospitals and countries which share a similar healthcare system.

In conclusion, in this real-life study, predictive rules, widely used in the ED for CAP to establish both the prognosis and the outcome, don’t seem to be of help in the decision about a proper discharge of a patient for OOH treatment. Many carefully selected patients, although by SSS application present a non-low risk of mortality, can be safely managed as outpatients if welfare, social and familiar resources are available. Our study doesn’t support international guideline recommendations that pneumonia severity scores should be used as an adjunct to clinical judgement when assessing the indication for outpatient management of CAP patients in the community. These findings may have implications for discharge planning and follow up of patients with CAP. A SSU in the ED can be an attractive alternative to prevent rebounds and new admissions during the 30 days following discharge in a subgroup of particularly CAP frail cases, identified by the presence of some laboratory and/or radiological “red flags”.

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- and as “community-acquired pneumonia rebounds after discharge from the emergency department” at the 2016 AcEMC National Scientific Meeting. Academy of Emergency Medicine and Care. Parma (Italy), May 20th 2016.

References

1. Wunderink RG, Waterer GW. Advances in the causes and management of community acquired pneumonia in adults. BMJ 2017; 358:j2471.
2. Feldman C, Anderson R. Community-acquired pneumonia: still a major burden of disease. Curr Opin Crit Care 2016; 22: 477-84.
3. Wunderink RG, Waterer GW. Community-Acquired Pneumonia. N Engl J Med 2014; 370: 543-51.
4. Lim WS, Baudouin SV, George RC, et al. Pneumonia Guidelines Committee of the BTS Standards of Care Committee. British Thoracic Society guidelines for the management of community acquired pneumonia in adults: update 2009. Thorax 2009; 64(Suppl III): iii1-iii55.
5. Viale P, Tedeschi S, Tumietto F, Ferrari R, et al. Prospective multicentre survey on clinical features and management approach to community-acquired pneumonia in emergency departments in Italy: focus on hospital admitted cases. Inf Med 2012; 4: 265-75.
6. Mandell LA, Wunderink RG, Anzueto A, et al. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. Clin Infect Dis 2007; 44: Suppl 2: S27-S72.
7. Yealy DM, Auble TE, Stone RA, et al. Effect of increasing the intensity of implementing pneumonia guidelines: a randomized, controlled trial. Ann Intern Med 2005; 143: 881-94.
8. Mandell LA, Bartlett JG, Dowell SF, et al. Update of practice guidelines for the management of community-acquired pneumonia in immunocompetent adults. Clin Infect Dis 2003; 37: 1405-33.
9. Niederman MS, Mandell LA, Anzueto A, et al. Guidelines for the management of adults with community-acquired pneumonia. Diagnosis, assessment of severity, antimicrobial therapy, and prevention. Am J Resp Crit Care Med 2001; 163: 1730-54.
10. Bartlett JG, Dowell SF, Mandell LA, et al. Practice guidelines for the management of community-acquired pneumonia in adults. Infectious Diseases Society of America. Clin Infect Dis 2000; 31: 347-82.
11. Dean NC, Suchyta MR, Bateman KA, et al. Implementation of admission decision support for community-acquired pneumonia. Chest 2000; 117: 1368-77.
12. Research Committee of the British Thoracic Society and the Public Health Laboratory Service. Community acquired pneumonia in adults in British hospitals in 1982-83; a survey of aetiology, mortality prognostic factors and outcome. Q J Med 1987; 62: 195-220.
13. Neill AM, Martin IR, Weir R, et al. Community acquired pneumonia: aetiology and usefulness of severity criteria on admission. Thorax 1996; 51: 1010-6.
14. Lim WS, van der Enden MM, Laing, R, et al. Defining community acquired pneumonia severity on presentation to hospital: an international derivation and validation study. Thorax 2003; 58: 377-82.
15. Fine MJ, Auble TE, Yealy DM, et al. A prediction rule to identify low-risk patients with community acquired pneumonia. N Eng J Med 1997; 336: 243-50.
16. Chalmers JD, Taylor JK, Mandal P, et al. Validation of the Infectious Diseases Society of America/American Thoracic Society minor criteria for intensive care unit admission in community-acquired pneumonia patients without major criteria or contraindications to intensive care unit care. Clin Infect Dis 2011; 53: 503-11.
17. Chalmers JD, Singanayagam A, Akram AR, et al. Safety and efficacy of CURB65-guided antibiotic therapy in community-acquired pneumonia. J Antimicrob Chemother 2011; 66: 416-23.
18. Chalmers JD, Singanayagam A, Akram AR, et al. Severity assessment tools for predicting mortality in hospitalized patients with community-acquired pneumonia. Systematic review and meta-analysis. Thorax 2010; 65: 878-83.
19. Loke YK, Kwok CS, Niruban A, Myint PK. Value of severity scales in predicting mortality from community-acquired pneumonia: systemic review and meta-analysis. Thorax 2010; 65: 884-90.
20. Rello J, Rodriguez A, Lisboa T, et al. Assessment of severity in ICU patients with community-acquired pneumonia using PIRO score. Crit Care Med 2009; 37: 456-62.
21. Charles PGP, Wolfe R, Whitby M, et al. SMART-COP: a tool for predicting the need for intensive respiratory or vaspressor support in community-acquired pneumonia. Clin Infect Dis 2008; 47: 375-84.
22. Man SY, Lee N, Ip M, et al. Prospective comparison of three predictive rules for assessing severity of community-acquired pneumonia in Hong Kong. Thorax 2007; 62: 348e53.
23. Lee RWW, Lindstrom ST. A teaching hospital’s experience applying the Pneumonia Severity Index and antibiotic guidelines in the management of community-acquired pneumonia. Respiriology 2007; 12: 754-8.
24. Barlow G, Nathwani D, Davey P. The CURB65 pneumonia severity score outperforms generic sepsis and early warning scores in predicting mortality in community-acquired pneumonia. Thorax 2007; 62: 253-9.
25. España PP, Capelastegui A, Gorordo I, et al. Development and validation of a predictive rule for severe community-acquired. Am J Respir Crit Care Med 2006; 174: 1249-56.
26. Capelastegui A, España PP, Quintana JM, et al. Validation of a predictive rule for the management of community acquired pneumonia. Eur Respir J 2006; 27: 15167.
27. Ranzani OT, Prina E, Menéndez R, et al. New Sepsis Definition (Sepsis-3) and Community-Acquired Pneumonia Mortality: a validation and clinical decision-making study. Am J Respir Crit Care Med 2017; in press.
28. Sersier DJ, Williams S, Bowler SD. Australasian respiratory and emergency physicians do not use the pneumonia severity index in community-acquired pneumonia. Respiriology 2013; 18: 291-296.
29. Chen JH, Chang SS, Liu JJ, et al. Comparison of clinical characteristics and performance of pneumonia severity score and CURB-65 among younger adults, elderly and very old subjects. Thorax 2010; 65: 971-977.
30. Ewig S, Torres A. Severity scores for CAP. Much workload for the next bias’. Thorax 2010; 65: 853-5.
31. Chalmers JD, Rutherford J. Can we use severity assessment tools to increase outpatient management of community-acquired pneumonia? Eur J Intern Med 2012; 23: 398-406.
32. Choudhury G, Chalmers JD, Mandal P, et al. Physician judgement is a crucial adjunct to pneumonia severity scores in low-risk patients. Eur Respir J 2011; 38: 643-8.
33. Seymann G, Barger K, Choo S, et al. Clinical judgment versus the Pneumonia Severity Index in making the admission decision. J Emerg Med 2008; 34: 261-8.
34. Arnold FW, Ramirez JA, McDonald LC, et al. Hospitalization for Community-Acquired Pneumonia. The Pneumonia Severity Index vs Clinical Judgment. Chest 2003; 124: 121-4.
35. Sharp AL, Jones JP, Wu I, et al. CURB-65 Performance Among Admitted and Discharged Emergency Department Patients With Community-acquired Pneumonia. Acad Emerg Med 2016; 23: 400-5.
36. Sbiti-Rohr D, Kutz A, Christ-Crain M, et al. The National Early Warning Score (NEWS) for outcome prediction in emergency department patients with community-acquired pneumonia...
pneumonia: results from a 6-year prospective cohort study. BMJ Open 2016; 6: e011021.
37. Chen YX, Wang JY, Guo SB. Use of CRB-65 and quick Sepsis-related Organ Failure Assessment to predict site of care and mortality in pneumonia patients in the emergency department: a retrospective study. Crit Care 2016; 20: 167.
38. Rodriguez C, McKeever TM, Woodhead M, et al, on behalf of the British Thoracic Society. Admission via the emergency department in relation to mortality of adults hospitalised with community-acquired pneumonia: an analysis of the British Thoracic Society national community-acquired pneumonia audit. Emerg Med J 2015; 32: 55-9.
39. Leis JA, Gold WL. Management of community-acquired pneumonia in the emergency department. CMAJ 2012; 184: 559.
40. Aliiberti S, Ramirez J, Cosentini R, Brambilla AM, et al. Low CURB-65 is of limited value in deciding discharge of patients with community-acquired pneumonia. Resp Med 2011; 105: 1732-8.
41. Augesky D, McCausland JB, Whittle J, et al. Reasons Why Emergency Department Providers Do Not Rely on the Pneumonia Severity Index to Determine the Initial Site of Treatment for Patients with Pneumonia. Clin Infect Dis 2009; 49: e100-e108.
42. Selz WH, Grijalva CG, Zhu Y, et al. Rates of Emergency Department Visits Due to Pneumonia in the United States, July 2006 – June 2009. Acad Emerg Med 2013; 20: 957-60.
43. Moran GJ, Rothman RE, Voluturo GA. Emergency management of community-acquired bacterial pneumonia: what is new since the 2007 Infectious Diseases Society of America/American Thoracic Society Guidelines. Am J Emerg Med 2013; 31: 602.
44. Renaud B, Coma E, Labare J, et al. Routine use of the Pneumonia Severity Index for guiding the site-of-treatment decision of patients with pneumonia in the emergency department: a multicenter, prospective, observational, controlled cohort study. Clin Infect Dis 2007; 44: 41-9.
45. Campbell SG, Patrick W, Urquhart DG, et al. Patients with community acquired pneumonia discharged from the emergency department according to a clinical practice guideline. Emerg Med J 2004; 21: 667-9.
46. Akram AR, Chalmers JD, Hill AT. Predicting mortality with severity assessment tools in out-patients with community-acquired pneumonia. QJM Med 2011; 104: 871-9.
47. Chalmers JD, Akram AR, Hill AT. Increasing outpatient treatment of mild community-acquired pneumonia: systematic review and meta-analysis. Eur Respir J 2011; 37: 858-64.
48. Atlas SJ, Benzer TI, Borowsky LH, et al. Safely Increasing the Proportion of Patients With Community-Acquired Pneumonia treated as Outpatients. Arch Intern Med 1998; 158: 1350-6
49. Marrie TJ, Lau CY, Wheeler SL, et al. A controlled trial of a critical pathway for treatment of community-acquired pneumonia. JAMA 2000; 283: 749-55.
50. Carratalà J, Fernández-Sabé N, Ortega L, et al. Outpatient care compared with hospitalization for community-acquired pneumonia: a randomized trial in low risk patients. Ann Intern Med 2005; 142: 165-72.
51. American Thoracic Society, Infectious Diseases Society of America. Guidelines for the management of adults with hospital-acquired, ventilation associated, and healthcare associated pneumonia. Am J Resp Crit Care Med 2005; 171: 388-416.
52. Ferrari R, Tumietto F, Giostra F, et al. Community Acquired Pneumonia in the Emergency Department: comparison of clinical indication to in-hospital treatment and severity scales predicting mortality. European Respiratory Journal 2012; 40 (556): 455-2015.
53. Ferrari R, Tumietto F, Tedeschi S, et al. Community Acquired Pneumonia in the Emergency Department: value and limits of prognostic severity scores. Emergency Care Journal 2012; 2: 44.
54. Kelly BJ, Matlaby MA. Prevalence and severity of neurologic dysfunction in critically ill patients. Influence on need for continued mechanical ventilation. Chest 1993; 104: 1818-24.
55. Selz WH, Grijalva CG, Zhu Y, et al. Rates of Emergency Departments Visits Due to Pneumonia in the United States, July 2006 – June 2009. Acad Emerg Med 2013; 20: 957-60.
56. Cillóniz C, Ewig S, Polverino E, et al. Community-Acquired pneumonia in outpatients: actiology and outcomes. Eur Respir J 2012; 40: 931-8.
57. Chalmers JD, Akram AR, Hill AT. Increasing outpatient treatment of mild community-acquired pneumonia: systematic review and meta-analysis. Eur Respir J 2011; 37: 858-64.
58. Adamuz J, Viasus D, Camprecios-Rodríguez, et al. A prospective cohort study of healthcare visits and rehospitalizations after discharge of patients with community-acquired pneumonia. Respirology 2011; 16: 1119-26.
59. Baldie DJ, Entwistle VA, Davey PG. The information and support needs of patients discharged after a short hospital stay for treatment of low-risk Community Acquired Pneumonia: implications for treatment without admission. BMC Pulm Med 2008; 8-11.
60. Dean NC, Griffith PP, Sorensen JS, et al. Pleural Effusions at First ED Encounter Predict Worse Clinical Outcomes in Patients With Pneumonia. Chest 2016; 149: 1509-15.