National Clinical Guideline Centre

Clinical evidence tables

Pneumonia

Severity assessment tools

Clinical guideline 191

Appendix G2

3 December 2014

Final version

Commissioned by the National Institute for Health and Care Excellence

Funding
National Institute for Health and Care Excellence

Contents

1 CAP

1.1 Severity assessment tools

1.1.1 Tools for assessing disease severity in people with LRTI in the community

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools (including thresholds used)</th><th>Outcomes measures/ Results</th><th>Comments</th></tr>
<tr><td rowspan="2">Author and year: Francis 2012[22]

Study type: prospective observational study in 14 primary care networks in 13 European countries with clinicians recording symptoms on presentation and management (part of Genomics to combat Resistance against Antibiotics in Community-acquired LRTI in Europe (GRACE) 01 study (www.grace-lrti.org) of acute cough)

Selection / patient setting: Participating general practitioners were asked to recruit consecutive eligible patients in October and November 2006 and from</td><td>Inclusion criteria:
Eligible patients were aged > 18 years who presented with an illness where an acute or worsened cough was the main or dominant symptom or the clinical presentation suggested an LRTI, with a duration of ≤ 28 days.

Exclusion criteria: NR

All patients,
N: 3,368 participants had complete data
Exclusions due to: incomplete data for CRB-65

Included N: 339 (12.6%) (complete data for CRB-65)

CRB-65 = 0: N (row %) 235 (69.3); Age, mean (SD) 42.8 (12.4); Prior duration of symptoms, median (IQR) 4 (3, 7); Baseline symptom severity score, mean (SD) 26.8 (6.0)
CRB-65 = 1: N (row %) 95 (28.0); Age, mean (SD) 63.3 (15.3); Prior duration of symptoms, median (IQR) 5 (3, 8); Baseline symptom severity score, mean (SD) 27.3 (6.2)
CRB-65 = 0: N (row %) 235 (69.3); Age, mean (SD) 74.1 (7.5); Prior duration of symptoms, median (IQR) 4 (3, 6); Baseline symptom severity score, mean (SD) 28.6 (6.9)
CRB-65 = 0: Age, mean (SD) 49.3 (16.5); Prior duration of symptoms, median (IQR) 5 (3, 7); Baseline symptom severity score, mean (SD) 27.0 (6.1)</td><td>CRB-65</td><td>Mortality (0%)
Hospitalization: 10/326 (3.1%)

OR (95% CI)
CRB-65 ≥ 1: 3.12 (0.16-60.24)
CRB-65: 2.26 (0.21- 24.54)
Interaction: 0.64 (0.02-18.41)

Results from the multivariate analysis for the outcome of hospitalization for the sample of 326 patients with complete data

*When the authors repeat the analysis with the whole sample (N = 2,545) with imputation of missing values they reported the OR (95%CI) for CRB-65 ≥ 1: 2.93 (0.77-11.17)</td><td>Funding: by the 6th Framework Programme of the European Commission (LSHM-CT-2005-518226), by the National Institute for Social Care and Health Research in Wales, and by the Research Foundation, Flanders (G.F0274.08N).

Limitations: very low rate of complete data for CRB-65 (12.6%)

Additional</td></tr>
</table>

Reference	Patient Characteristics					Risk Assessment tools (including thresholds used)	Outcomes measures/ Results	Comments
late January to March 2007. (source: GRACE study) **Addressing missing data/non reliability of data**: Patients with missing data for any of these parameters were given a missing CRB-65 score. **Statistical analysis (including confounders adjusted for):** hierarchical logistic regression model and Cox proportional hazards modelling (with patients nested within clinicians), and controlling for antibiotic prescribing.	Antibiotics prescribed (column %)	165 (70.2)	70 (73.7)	7 (77.8)	242 (71.4)			**outcomes**: The authors also analysed the role of CRB-65 to predict prolonged moderately severe illness and time to recovery. None of these outcomes were significantly associated with elevated CRB-65 scores in the sample of patients with complete dataset. **Notes:**
	Duration of moderately bad symptoms in days, median (IQR)	6 (4, 9)	7 (4, 14)	7 (5, 14)	6 (4, 10)			
	Prolonged illness† (N = 334), N (%)	11 (4.8)	9 (9.5)	0 (0)	20 (6.0)			
	Hospitalisation (N = 326), N (%)	5 (2.2)	5 (5.5)	0 (0)	10 (3.1)			
	Day recovered, median (IQR)	12 (8, 21)	15 (10, 22)	19.5 (13, 22)	13 (8, 21)			

<table>
<tr><th>Reference</th><th>Patient characteristics</th><th>Risk assessment tools</th><th>Outcomes measured</th><th>Results</th><th>Comments</th></tr>
<tr>
<td rowspan="4">Author and year:
Bont et al. 2008[10]
Study type:
Prospective, validation study using the derivation cohort from Lim et al. (hospital setting)

Selection/patient setting:
Patients with CXR-confirmed or suspected CAP presenting to primary care in The Netherlands

Addressing missing data/non</td>
<td>Diagnosis: CXR-confirmed or suspected CAP</td>
<td rowspan="4">CRB-65:
Low risk 0
Intermediate risk 1 or 2
High risk ≥ 3</td>
<td>30-day mortality</td>
<td>30-day mortality, n (%): 11 (3.5)
30-day hospitalisation, n (%): 47 (15)</td>
<td rowspan="2">Funding:
Personal grant by The Netherlands Scientific Organisation to Dr Bont</td>
</tr>
<tr>
<td>Inclusion criteria:
presence of new localizing signs on chest examination or new infiltrates on CXR, or when the GP had a strong suspicion of the patient having CAP because of severe dyspnoea in a very ill patient (even without chest signs)</td>
<td>30-day hospitalisation</td>
<td>
<table>
<tr><th>CRB-65</th><th>30-day mortality in original data by Lim et al. n (%)</th><th>30-day mortality in present study, n (%)</th></tr>
<tr><td>0</td><td>2 (0.9)</td><td>0</td></tr>
<tr><td>1</td><td>18 (5.2)</td><td>2 (0.9)</td></tr>
<tr><td>2</td><td>30 (11.8)</td><td>5 (8.2)</td></tr>
<tr><td>3</td><td>36 (32.4)</td><td>4 (17.4)</td></tr>
<tr><td>4</td><td>3 (21.4)</td><td>0</td></tr>
</table>
Comparison of test characteristics of CRB-65 score ≥ 2 between the two studies
<table>
<tr><th></th><th>Sensitivity (%)</th><th>Specificity (%)</th><th>PPV (%)</th><th>NPV (%)</th></tr>
<tr><td>Lim et al. study</td><td>76.8</td><td>64.3</td><td>18.6</td><td>96.3</td></tr>
<tr><td>Present study</td><td>82.2</td><td>75.2</td><td>10.7</td><td>99.1</td></tr>
</table>
</td>
<td>Limitations:
Mortality rates are low in primary care, therefore new studies may need to investigate less severe outcomes</td>
</tr>
<tr>
<td>Exclusion criteria: patients with lung cancer, haematologic malignant neoplasm, HIV-infection, use of immunosuppressive medication, hospitalised during the 2 weeks preceding diagnosis, or nursing home residents</td>
<td colspan="2"></td>
<td rowspan="2">Additional outcomes:
Mortality according to hospital referral

Notes: “CRB-65 identifies low-risk patients in an elderly population in primary care and suggests</td>
</tr>
<tr>
<td>All patients:</td>
<td colspan="2"></td>
</tr>
</table>

Reference	Patient characteristics	Risk assessment tools	Outcomes measured	Results	Comments
reliability of data: **Statistical analysis (including confounders adjusted for):** ROC analysis (validation study)	N: 315 Exclusion reasons: NR				that age alone is not a sufficient reason to classify patients as high risk"
	Included: N: 315				
	Age, mean: 77.3 **Age ≥ 65:** 100%				
	Gender: male, n (%): 145 (46)				
	Nursing home patients: excluded				
	Pneumonia severity, n (%): CRB-65 0: 0 CRB-65 1: 230 (73.2) CRB-65 2: 61 (19.4) CRB-65 3: 23 (7.3) CRB-65 4: 0				

1.1.2 Tools for assessing disease severity in people with CAP at first presentation

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
Author and year: Buising et al. 2006[12] **Study type:** Prospective **Selection / patient setting:** Tertiary teaching hospital in Melbourne. Adults admitted to hospital with a diagnosis of CAP **Addressing missing data/non reliability of data:** Data missing for 20 patients who	**Diagnosis:** CAP diagnosis was based on clinical assessment, initial pathology results, and CXR assessment by the clinician **Inclusion criteria:** Adults with a diagnosis of CAP **Exclusion criteria:** Aged < 18 years HAP (admitted to hospital for more than 48 hours within 2 weeks prior to presentation) Immunosuppression **All patients,** N: 392 Exclusions reasons: NR **Included** N: 392 **Age, median (range):** 74 (18-96)	• PSI • CURB • CURB-65 • revised ATS (2001): one of the 2 major criteria or 2 of 3 minor criteria • modified BTS (2001): the 4 CURB variables are assessed and if a patient has ≥ 2 variables they are classed as severe	• Mortality • ICU admission	a) Mortality , n (%); 37 (9.4) b) ICU admission, n (%): 26 (6.6) c) Predictive value of severity tools for mortality	**Funding:** National health and medical research council of Australia **Limitations** • 45 patients did not have a discharge diagnosis of pneumonia despite initial diagnosis, but authors support the inclusion of this group in the evaluation as it reflects the real-life context in which these tools will be used **Additional outcomes**: **Notes:** Mortality time point not

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr><td>had no blood tests performed.

Statistical analysis (including confounders adjusted for): ROC analysis</td><td>Gender: male, n (%): 324 (59.7)

Nursing home patients, n (%): 55 (14)

Comorbidities > 10%, n (%):
• Neoplastic disease: 54 (13.7)
• Congestive heart failure: 80 (20.4)
• Cerebrovascular disease: 74 (18.8)
• Chronic renal failure: 47 (11.9)
• COPD: 92 (23.4)
• Dementia/neurological disease: 52 (13.2)
• Diabetes: 87 (22.1)

Pneumonia severity
<table>
<tr><th>Severity tool</th><th>Patients, n (%)</th></tr>
<tr><td>PSI</td><td></td></tr>
<tr><td>I</td><td>346 (27.9)</td></tr>
<tr><td>II</td><td>325 (26.2)</td></tr>
</table></td><td></td><td></td><td>
<table>
<tr><th>Severity tool</th><th>Sensitivity % (95% CI)</th><th>Specificity % (95% CI)</th><th>PPV % (95% CI)</th><th>NPV % (95% CI)</th><th>ROC (95% CI)</th></tr>
<tr><td>PSI V</td><td>67.5 (50.2-81.9)</td><td>82.1 (77.6-85.9)</td><td>28.4 (19.3-39.0)</td><td>96.0 (93.1-97.9)</td><td>0.82 (0.76-0.87)</td></tr>
<tr><td>PSI IV+V</td><td>97.3 (85.8-99.9)</td><td>47.9 (42.5-53.2)</td><td>16.4 (11.7-22.0)</td><td>99.4 (96.7-99.9)</td><td>0.82 (0.76-0.87)</td></tr>
<tr><td>CURB (≥2)</td><td>89.2 (74.5-</td><td>58.1 (52.7-</td><td>18.3 (12.9-</td><td>98.1 (95.1-</td><td>0.82 (0.75-</td></tr>
</table></td><td>specified</td></tr>
</table>

Reference	Patient Characteristics		Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments

						96.9)	63.3)	24.7)	99.4)	0.88)
	III	241 (19.4)			CURB-65 (≥ 3)	81 (64.8-92.0)	67.9 (62.7-72.7)	20.8 (14.5-28.4)	97.2 (94.2-98.8)	0.82 (0.76-0.88)
	IV	165 (13.3)			Revised ATS	40.5 (24.7-57.9)	84.6 (80.4-88.2)	21.7 (12.7-33.3)	93.1 (89.7-95.6)	0.63 (0.54-0.71)
	V	97 (7.8)			**Severity tool**	**Sensitivity % (95% CI)**	**Specificity % (95% CI)**	**PPV % (95% CI)**	**NPV % (95% CI)**	**ROC (95% CI)**
	Revised ATS severe	70 (17.8)			PSI V	67.5 (50.2-81.9)	82.1 (77.6-85.9)	28.4 (19.3-39.0)	96.0 (93.1-97.9)	0.82 (0.76-0.87)
	CURB severe	182 (46.4)			PSI IV+V	97.3 (85.8-99.9)	47.9 (42.5-53.2)	16.4 (11.7-22.0)	99.4 (96.7-99.9)	0.82 (0.76-0.87)
	CURB-65 severe (3)	161 (41.0)								
	LOS, median (range): 4 (1-76) days				d) Predictive value of severity tools for ICU admission					

Severity tool	Sensitivity % (95% CI)	Specificity % (95% CI)	PPV % (95% CI)	NPV % (95% CI)	ROC (95% CI)
PSI V	48 (27.8-68.7)	79 (74.5-83.1)	13.6 (7.2-22.6)	95.6 (92.7-97.6)	0.69 (0.59-0.77)
PSI IV+V	84 (63.9-95.4)	45.4 (40.2-50.7)	9.6 (6.0-14.3)	97.6 (94.0-99.3)	0.69 (0.59-0.77)
CURB (≥ 2)	84 (63.9-95.4)	56.2 (50.9-61.3)	11.7 (7.3-17.2)	98.1 (95.1-99.4)	0.76 (0.68-0.84)
CURB-65 (≥ 3)	57.7 (36.9-76.6)	64.7 (59.6-69.6)	10.4 (5.9-16.6)	95.5 (92.2-97.7)	0.66 (0.56-0.76)
Revised ATS	92 (73.9-99.0)	87.3 (83.4-90.5)	33.3 (22.4-45.7)	99.3 (97.7-99.4)	0.90 (0.81-0.94)
Modified BTS	96.0 (79.6-99.9)	48.7 (43.5-54.0)	11.4 (7.4-16.5)	99.4 (96.9-99.9)	0.72 (0.67-0.76)

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Phua et al. 2009[36]
Study type:
Retrospective

Selection / patient setting:
University hospital in Singapore. Adults admitted to hospital with a diagnosis of CAP

Addressing missing data/non reliability of data:

Statistical</td>
<td>Diagnosis:
CAP was defined as an acute infection of the pulmonary parenchyma associated with infiltrates on CXR and two or more clinical symptoms consistent with pneumonia (new cough or change in colour of respiratory secretions, dyspnoea, fever, hypothermia, rigors, and/or chest discomfort)
Inclusion criteria:
Adults with a diagnosis of CAP
Exclusion criteria:
• Hospitalised within 14 days of the onset of symptoms or discharged from the emergency department
• Immunocompromised
• Patients subsequently diagnosed with tuberculosis
• Patients who fulfilled any IDSA/ATS major criteria for severe CAP on presentation
All patients,
N: 1310
Exclusions reasons: 68 fulfilled IDSA/ATS major criteria for severe</td>
<td>• PSI
• IDSA/ATS minor criteria
• CURB-65

High-risk patients were defined as having IDSA/ATS minor criteria ≥ 3, PSI IV or V, and CURB-65 ≥ 3</td>
<td>In hospital mortality</td>
<td>a) Hospital mortality n (%): 183 (14.7)
b) AUC (95% CI) predicting in hospital mortality:
• PSI: 0.86 (0.83-0.88)
• CURB-65: 0.82 (0.78-0.85)
• IDSA/ATS minor criteria: 0.88 (0.86-0.91)
c) Number of deaths according to IDSA/ATS number of criteria:
<table>
<tr><th>Number of criteria</th><th>Number of deaths, n (%)</th></tr>
<tr><td>0</td><td>3 (0.9)</td></tr>
<tr><td>1</td><td>5 (1.5)</td></tr>
<tr><td>2</td><td>26 (10.8)</td></tr>
<tr><td>3</td><td>58 (35.2)</td></tr>
<tr><td>4</td><td>41 (42.3)</td></tr>
<tr><td>5</td><td>29 (61.7)</td></tr>
<tr><td>6</td><td>19 (100.0)</td></tr>
<tr><td>7</td><td>2 (100.0)</td></tr>
</table>
d) Prediction of hospital mortality by severity tool
<table>
<tr><th>Severity tool</th><th>ROC (95% CI)</th><th>Sensitivity %</th><th>Specificity %</th><th>PPV %</th><th>NPV %</th></tr>
<tr><td colspan="6">IDSA/ATS minor criteria</td></tr>
<tr><td>≥ 1</td><td>0.65 (0.62-0.69)</td><td>98.4</td><td>32.4</td><td>20.1</td><td>99.1</td></tr>
<tr><td>≥ 2</td><td>0.79 (0.76-0.82)</td><td>95.6</td><td>62.6</td><td>30.6</td><td>98.8</td></tr>
<tr><td>≥ 3</td><td>0.82 (0.79-0.86)</td><td>81.4</td><td>82.9</td><td>45.2</td><td>96.3</td></tr>
<tr><td>≥ 4</td><td>0.71 (0.67-0.76)</td><td>49.7</td><td>93</td><td>55.2</td><td>91.5</td></tr>
<tr><td>≥ 5</td><td>0.63 (0.58-0.68)</td><td>27.3</td><td>98.3</td><td>73.5</td><td>88.7</td></tr>
<tr><td>≥ 6</td><td>0.56 (0.51-0.61)</td><td>11.5</td><td>100</td><td>100</td><td>86.7</td></tr>
</table>
</td>
<td>Funding:
None

Limitations:
• Data collection performed using medical records
• Hospital mortality was higher than other studies, which might be due to different forms of mortality used. In this study, in-hospital mortality was chosen</td>
</tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr><td>analysis (including confounders adjusted for):
ROC analysis
Chi test and Student t test</td><td>CAP
Included N: 1242
Age, mean (SD): 65.7 (20.1)
Age ≥ 65 years, n (%): 759 (61.1)
Gender: male, n (%): 761 (61.3)
Nursing home patients, n (%): 153 (12.3)
Comorbidities, n (%):
Neoplastic disease: 81 (6.5)
Heart failure: 201 (16.2)
Cerebrovascular disease: 341 (27.5)
Renal disease: 131 (10.5)

Pneumonia severity according to number of IDSA/ATS minor criteria
<table><tr><th>Number of criteria</th><th>Patients, n (%)</th></tr><tr><td>0</td><td>346 (27.9)</td></tr><tr><td>1</td><td>325 (26.2)</td></tr><tr><td>2</td><td>241 (19.4)</td></tr><tr><td>3</td><td>165 (13.3)</td></tr><tr><td>4</td><td>97 (7.8)</td></tr><tr><td>5</td><td>47 (3.8)</td></tr><tr><td>6</td><td>19 (1.5)</td></tr><tr><td>7</td><td>2 (0.2)</td></tr></table>LOS, mean (SD):</td><td></td><td></td><td><table><tr><td>7</td><td>0.51 (0.46-0.55)</td><td>1.1</td><td>100</td><td>100</td><td>85.4</td></tr><tr><td colspan="6">PSI class</td></tr><tr><td>≥ II</td><td>0.59 (0.55-0.63)</td><td>100</td><td>17</td><td>17.2</td><td>100</td></tr><tr><td>≥ III</td><td>0.68 (0.64-0.71)</td><td>99.5</td><td>36.2</td><td>21.2</td><td>99.7</td></tr><tr><td>≥ IV</td><td>0.77 (0.74-0.80)</td><td>96.2</td><td>57.9</td><td>28.3</td><td>98.9</td></tr><tr><td>V</td><td>0.77 (0.73-0.82)</td><td>68.3</td><td>86.6</td><td>46.8</td><td>94.1</td></tr><tr><td colspan="6">CURB-65</td></tr><tr><td>≥ 1</td><td>0.63 (0.59-0.67)</td><td>97.8</td><td>28.4</td><td>19.1</td><td>98.7</td></tr><tr><td>≥ 2</td><td>0.74 (0.71-0.78)</td><td>89.1</td><td>59.2</td><td>27.4</td><td>96.9</td></tr><tr><td>≥ 3</td><td>0.72 (0.68-0.77)</td><td>61.2</td><td>83.3</td><td>38.8</td><td>92.5</td></tr><tr><td>≥ 4</td><td>0.62 (0.57-0.67)</td><td>27.3</td><td>93.7</td><td>58.8</td><td>88.5</td></tr><tr><td>5</td><td>0.53 (0.49-0.58)</td><td>6.6</td><td>100</td><td>100</td><td>86.1</td></tr></table></td><td>as outcome instead of 30-day mortality
• Further research comparing IDSA/ATS with new predictions rules such as SMART-COP and SCAP will be needed

Additional outcomes: Table 2 reports mortality RR for each individual IDSA/ATS criteria

Notes: In-hospital mortality-</td></tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>time period not reported</td></tr>
<tr><td></td><td></td><td></td><td></td><td>e) Relative risk (RR) of hospital mortality by severity tool
<table>
<tr><th>Severity tool</th><th>RR (95% CI)</th></tr>
<tr><th colspan="2">IDSA/ATS minor criteria</th></tr>
<tr><td>≥ 1</td><td>23.17 (7.45-72.03)</td></tr>
<tr><td>≥ 2</td><td>25.71 (12.77-51.75)</td></tr>
<tr><td>≥ 3</td><td>12.11 (8.53-17.20)</td></tr>
<tr><td>≥ 4</td><td>6.46 (5.08-8.20)</td></tr>
<tr><td>≥ 5</td><td>6.49 (5.24-8.04)</td></tr>
<tr><td>≥ 6</td><td>7.54 (6.53-8.70)</td></tr>
<tr><td>7</td><td>6.85 (5.99-7.84)</td></tr>
<tr><th colspan="2">PSI class</th></tr>
<tr><td>≥ II</td><td>NA*</td></tr>
<tr><td>≥ III</td><td>81.46 (11.46-579.23)</td></tr>
<tr><td>≥ IV</td><td>25.06 (11.87-52.91)</td></tr>
<tr><td>V</td><td>7.87 (5.95-10.42)</td></tr>
<tr><th colspan="2">CURB-65</th></tr>
<tr><td>≥ 1</td><td>14.57 (5.45-38.91)</td></tr>
<tr><td>≥ 2</td><td>8.86 (5.65-13.91)</td></tr>
<tr><td>≥ 3</td><td>5.20 (3.98-6.79)</td></tr>
<tr><td>≥ 4</td><td>5.12 (4.03-6.50)</td></tr>
<tr><td>5</td><td>7.19 (6.26-8.27)</td></tr>
</table>
*NA due to NPV of 100%
The logistic regression model adjusted for delay to ICU admission and</td><td></td></tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
				included number of PSI points (as it incorporates patient demographics, chronic conditions and acute parameters).	

Reference	Patient Characteristics	Risk Assessment tools (including thresholds used)	Outcomes measures/ Results	Comments

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools (including thresholds used)</th><th>Outcomes measures/ Results</th><th>Comments</th></tr>
<tr>
<td>Author and year: Kim et al, 2013[27]

Study type: prospective multicentre study in 14 hospitals (13 were teaching centers and 1 was a secondary hospital) in Korea

Selection / patient setting: consecutive patients in the participating hospitals were selected.

Addressing missing data/non reliability of data: none mentioned.

Statistical analysis (including confounders adjusted for): Both outcomes were analysed using a chi-square test. No adjustment for confounders was performed.</td>
<td>Inclusion criteria:
Eligible patients were aged >18 years who presented with CAP (defined as shadowing on an admission chest radiograph or computed tomography in 48 h after admission and showing new infiltration or consolidation or pleural effusion consistent with pneumonia.

Exclusion criteria: hospital acquired pneumonia, hospitalization over 72 hours in previous 14 days, patients with tuberculosis, secondary pneumonia, conditions likely to cause diagnostic confusion or where chest radiograph changes were equivocal, immunocompromised patients, neutropenia, leukemia, lymphoma, HIV infection, and splenectomy.

All patients,
N: 883 (882 were inpatients)
Exclusions due to: none
Included N: 883
<table>
<tr><td></td><td>Sample (N=883)</td></tr>
<tr><td></td><td></td></tr>
<tr><td>- Age<50 years
- Female
- Nursing home resident</td><td>-20.5%
- 40.7%
- 1.1%</td></tr>
<tr><td>Coexisting medical conditions
- Congestive heart failure
- Cerebrovascular diseas
- Neoplastic disease
- Renal disease
- Liver disease</td><td>
-6%

-9.2%
- 8.2%
- 3.3%
- 3.1%</td></tr>
</table>
</td>
<td>PSI
CURB-65</td>
<td>30-day mortality: 40/883 (4.5%_
ICU admission: 9.1%

<table>
<tr><th>PSI</th><th>30-day mortality (n, %)</th><th>ICU admission (n, %)</th></tr>
<tr><td>I (≤50) (n=174)</td><td>4 (2.3%)</td><td>9 (5.2%)</td></tr>
<tr><td>II (51-70) (n=182)</td><td>5 (2.7%)</td><td>5 (2.7%)</td></tr>
<tr><td>III (71-90) (n=213)</td><td>5 (2.3%)</td><td>9 (4.2%)</td></tr>
<tr><td>IV (91-130) (n=245)</td><td>11 (4.5%)</td><td>29 (11.8%)</td></tr>
<tr><td>V (>130) (n=69)</td><td>14 (21.7%)</td><td>28 (40.6%)</td></tr>
</table>

<table>
<tr><th>CURB-65</th><th>30-day mortality (n, %)</th><th>ICU admission (n, %)</th></tr>
<tr><td>0 (n=260)</td><td>6 (2.3%)</td><td>11 (4.2%)</td></tr>
<tr><td>1 (n=300)</td><td>12 (4%)</td><td>17 (5.7%)</td></tr>
<tr><td>2 (n=216)</td><td>13 (6%)</td><td>23 (10.6%)</td></tr>
<tr><td>3 (n=88)</td><td>5 (5.7%)</td><td>17 (19.3%)</td></tr>
<tr><td>4 (n=17)</td><td>4 (23.5%)</td><td>10 (58.8%)</td></tr>
<tr><td>5 (n=2)</td><td>0</td><td>2 (100%)</td></tr>
</table>
</td>
<td>Funding:
By a grant from the Korea Healthcare Technology R&D Project, Ministry for Health & Welfare, Republic of Korea (A102065).
Limitations:
Almost all the participants in the study were inpatients/ multicentre study

Additional outcomes: The authors also analysed the causes of death and compared their results to those of derivation studies.

Notes:</td>
</tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Jeong et al. 2011[25]
Study type:
Retrospective

Selection / patient setting:
Emergency department of a tertiary hospital in Korea. Adults admitted to hospital with a diagnosis of CAP

Addressing missing data/non reliability of data:</td>
<td>Diagnosis:
Acute illness with clinical features of pneumonia and infiltrates on CXR
Inclusion criteria:
Adults with a diagnosis of CAP
Exclusion criteria:
• Hospital-acquired pneumonia
• Transfer from other hospitals prior to admission
• Recent administration of antibiotics
• Presence of aspiration tendency
• Patients who left the hospital against medical advice
• Presence of other infectious diseases
• If a patient was admitted more than once during a 6-month period, only the first hospitalisation was included
All patients,
N: 526
Included N: 502
Age, mean years (SD): survival group – 67.58 (15.83), non-survivors – 77.03 (8.84)
Gender: male, n (%): survival</td>
<td>• PSI
• CURB-65
• APACHE II</td>
<td>30-day mortality</td>
<td>a) 30-day mortality n (%): 61 (12.15)
b) AUC (95% CI) predicting 30-day mortality:
• PSI: 0.795 (0.742 to 0.848)
• CURB65: 0.764 (0.703 to 0.825)
• APACHE II: 0.847 (0.804 to 0.890)
c) 30-day mortality
<table>
<tr><th>PSI criteria</th><th>30-day mortality, n (%)</th></tr>
<tr><td>I</td><td>0 (0)</td></tr>
<tr><td>II</td><td>1 (1.6)</td></tr>
<tr><td>III</td><td>9 (14.8)</td></tr>
<tr><td>IV</td><td>24 (39.3)</td></tr>
<tr><td>V</td><td>27 (44.3)</td></tr>
<tr><th>CURB65</th><th>30-day mortality, n (%)</th></tr>
<tr><td>0</td><td>1 (1.6)</td></tr>
<tr><td>1</td><td>10 (16.4)</td></tr>
<tr><td>2</td><td>21 (34.4)</td></tr>
<tr><td>3</td><td>17 (27.9)</td></tr>
<tr><td>4</td><td>11 (18.0)</td></tr>
<tr><td>5</td><td>1 (1.6)</td></tr>
</table>
</td>
<td>Funding:
NR

Limitations:
• Retrospective design
• Conducted at a single hospital

Additional outcomes:

Notes:</td>
</tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr><td>Statistical analysis (including confounders adjusted for):
ROC analysis</td><td>group – 254 (57.6), non-survivors – 43 (70.5)
Nursing home patients, n (%): NR
Comorbidities >10%, n (%):
Neoplastic disease: 71 (14)
Cerebrovascular: 83 (16.5)
Diabetes: 122 (24.3)
Hypertension: 184 (36.6)
Tuberculosis: 72 (14.3)
Asthma and COPD: 73 (14.5)

Pneumonia severity according to PSI and CURB65 criteria
<table>
<tr><th>PSI criteria</th><th>Patients, n</th></tr>
<tr><td>I</td><td>43</td></tr>
<tr><td>II</td><td>79</td></tr>
<tr><td>III</td><td>125</td></tr>
<tr><td>IV</td><td>173</td></tr>
<tr><td>V</td><td>82</td></tr>
<tr><th>CURB65</th><th>Patients, n</th></tr>
<tr><td>0</td><td>92</td></tr>
<tr><td>1</td><td>174</td></tr>
<tr><td>2</td><td>141</td></tr>
<tr><td>3</td><td>73</td></tr>
<tr><td>4</td><td>21</td></tr>
<tr><td>5</td><td>2</td></tr>
</table></td><td></td><td></td><td></td><td></td></tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
	APACHE II, mean (SD): survival group 10.88 (5.49), non-survivors 19.33 (6.33) **LOS, mean (SD):** NR				

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
Author and year: Bello et al. 2012[9] **Study type:** Prospective **Selection / patient setting:** Consecutive patients admitted to the emergency department of a University hospital in Spain. Adults admitted to hospital with a diagnosis of CAP **Addressing missing**	**Diagnosis:** Acute illness with symptoms of LRTI and new infiltrate on CXR **Inclusion criteria:** Adults with a diagnosis of CAP **Exclusion criteria:** Severe immunosuppression or patients having immunosuppressive therapy, leucopenia or neutropenia and/or chemotherapy in the previous year, pulmonary abscess, aspiration pneumonia and obstructive pneumonia, possible or known active neoplasia **All patients,** N: 260 **Included** N: 228 **Age, median years (SD):** 73 (60 - 80) **Gender: male, n (%):** 139 (61) **Nursing home patients, n (%):** NR **Comorbidities > 10%, n (%):** • Not-active neoplasia: 30 (13.2) • Heart disease: 84 (36.8) • Cerebrovascular disease: 47 (20.6) • COPD: 72 (31.6) • Renal disease: 35 (15.4) • Chronic renal disease: 27 (11.8) • Diabetes: 44 (19.3)	• PSI • CURB-65	• 30-day mortality	a) 30-day mortality n (%): 13/224 (5.8) b) AUC (95% CI) for predicting 30-day mortality: • PSI: 0.858 (0.805 – 0.901) • CURB65: 0.851 (0.798 – 0.895)	**Funding:** Grant from the Aragon respiratory apparatus society (SADAR) **Limitations:** • Study focused on the role of proadrenomedullin to predict mortality • Single hospital **Additional outcomes**: **Notes:**

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr><td>data/non reliability of data:

Statistical analysis (including confounders adjusted for):
ROC analysis</td><td>Pneumonia severity according to PSI and CURB65 criteria
<table><tr><th>PSI criteria</th><th>Patients, n (%)</th></tr><tr><td>I</td><td>19 (8.3)</td></tr><tr><td>II</td><td>30 (13.2)</td></tr><tr><td>III</td><td>40 (17.5)</td></tr><tr><td>IV</td><td>85 (37.3)</td></tr><tr><td>V</td><td>54 (23.7)</td></tr><tr><th>CURB65</th><th>Patients, n (%)</th></tr><tr><td>0</td><td>33 (14.5)</td></tr><tr><td>1</td><td>60 (26.3)</td></tr><tr><td>2</td><td>86 (37.7)</td></tr><tr><td>3</td><td>32 (14.0)</td></tr><tr><td>4</td><td>12 (5.3)</td></tr><tr><td>5</td><td>5 (2.2)</td></tr></table>
LOS, mean (SD): NR</td><td></td><td></td><td></td><td></td></tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Kontou et al. 2009[29]

Study type:
Retrospective

Selection / patient setting:
Private teaching hospital in Hartford, USA. Adults admitted to hospital with a diagnosis of CAP caused by S pneumoniae

Addressing missing data/non reliability of data:

Statistical analysis (including confounders adjusted for):</td>
<td>Diagnosis:
CAP was diagnosed based on clinical signs and symptoms, including new infiltrate on CXR, and at least one sputum culture or 2 blood cultures positive for S. pneumoniae
Inclusion criteria: [from previous study, Sun2006]
Adults (≥ 18 years) with a diagnosis of CAP caused by S. pneumonia. Patients were included if they were ≥ 18 years old; had at least one sputum culture or two blood cultures positive for S. pneumoniae; and had signs and symptoms consistent with the diagnosis of CAP including the presence of a new infiltrate on chest radiograph and at least two of the following within 1 day of the first positive culture: fever or hypothermia; WBC count > 10,000/µL or > 15% bands or leukopenia (WBC < 4,500/µL); auscultatory findings on pulmonary examination and/or evidence of pulmonary consolidation; new cough with or without sputum production; new-onset dyspnoea or tachypnoea; or hypoxemia with a Po2 < 60mm Hg</td>
<td>• PSI
• IDSA/ATS 2007: ≥ 1 of 2 major criteria, and ≥ 3 of 9 minor criteria
• ATS 2001: ≥ 1 of 2 major criteria, and ≥ 2 of 3 minor criteria
• CURB: ≥ 2 of 4 criteria</td>
<td>Mortality</td>
<td>a) Mortality, n (%): 20 (12.6)
b) ICU admission, n (%): 31 (19.6)
c) Multivariable regression model to identify variables independently associated with mortality; OR (95% CI, p)
• PSI V: 3.76 (1.31-10.82, p = 0.014)

The multivariate model included all variables with p>0.2 in the univariate analysis:
- OR for mortality: PSI V and mechanical ventilation
- OR for ICU admission: tachypnoea, confusion, PaO2/FiO2 ratio≤250, hypotension

d) Predictive value of different tools for mortality
<table>
<tr><th>Severity tool</th><th>Sensitivity %</th><th>Specificity %</th><th>PPV %</th><th>NPV %</th></tr>
<tr><td>IDSA/ATS</td><td>75</td><td>65</td><td>24</td><td>95</td></tr>
<tr><td>ATS</td><td>65</td><td>71</td><td>25</td><td>93</td></tr>
<tr><td>PSI IV+V</td><td>95</td><td>49</td><td>21</td><td>99</td></tr>
<tr><td>PSI V</td><td>50</td><td>82</td><td>29</td><td>92</td></tr>
<tr><td>CURB (≥ 2)</td><td>50</td><td>75</td><td>22</td><td>91</td></tr>
</table>
e) Predictive value of different tools for ICU admission
<table>
<tr><th>Severity tool</th><th>Sensitivity %</th><th>Specificity %</th><th>PPV %</th><th>NPV %</th></tr>
<tr><td>IDSA/ATS</td><td>90</td><td>72</td><td>44</td><td>97</td></tr>
<tr><td>ATS</td><td>90</td><td>80</td><td>53</td><td>97</td></tr>
</table>
</td>
<td>Funding:
None

Limitations
• Retrospective design; however, all data to assess each criteria were available or calculated from the ED admission log
• 26 patients were admitted from a nursing home, which represents a HCAP population; however, as all cases had confirmed pneumococcal pneumonia, these patients are no different from CAP (aetiology is the</td>
</tr>
</table>

X^2 test, *t* test or Mann-Whitney test	on room air **Exclusion criteria: [from previous study, Sun2006]** Patients were excluded if their total hospitalization was < 2 days, if they were immunocompromised, had known or suspected tuberculosis, known or suspected Pneumocystis jiroveci, or concomitant pneumonia or other infection at baseline caused by viruses, fungi, or other bacteria except intracellular pathogens **All patients,** N: 158 Exclusions reasons: NR **Included** N: 158 **Age, mean (SD):** 63.1 (18.9) **Gender: male, n (%):** 80 (50.6) **ursing home patients, n (%):** 26 (16.5) **Comorbidities > 10%, n (%):** • Diabetes: 34 (21.5) • COPD: 43 (27.2) • Neoplastic disease: 17 (10.8) • Heart failure: 22 (13.9) **Pneumonia severity:** **PSI class** / **Patients, n (%)** I: 11 (7) II: 21 (13.3) III: 37 (23.4) IV: 54 (34.2) V: 35 (22.1) **LOS, mean (SD):** 8.8 (8)				PSI IV+V: 81 / 50 / 28 / 91 PSI V: 45 / 83 / 40 / 90 CURB (≥ 2): 58 / 79 / 40 / 89	main differentiation between these populations) **Additional outcomes**: **Notes:** Mortality- time period not reported Only PSI V and mechanical ventilation were independently associated with mortality (r^2 = 0.240). Non-significant variables were removed from the final model

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Chang et al. 2013[17]
Study type:
Prospective

Selection / patient setting:
Two large hospitals in New Zealand. Adults admitted to hospital with a diagnosis of CAP

Addressing missing data/non reliability of data:

Statistical analysis</td>
<td>Diagnosis:
Acute illness with clinical features of pneumonia and infiltrates on CXR
Inclusion criteria:
Adults with a diagnosis of CAP
Exclusion criteria:
• Pneumonia was not the main reason for admission
• Pneumonia was associated with bronchial obstruction, bronchiectasis, or tuberculosis
• Severely immunocompromised with neutropenia, HIV infection or currently receiving cancer chemotherapy
• Hospitalised within the previous 14 days or transferred from a long term hospital-level care facility
All patients,
N: 474
Included N: 453
Age ≥ 65 years, n (%): 264 (58)
Gender: male, n (%): 233 (51)
Nursing home patients, n (%): NR
Comorbidities >10%, n (%):
Chronic lung disease: 171 (37.7)
Heart failure: 94 (20.7)
Diabetes: 54 (12)
Cerebrovascular disease: 52 (11.4)</td>
<td>• PSI
• CURB-65</td>
<td>30-day mortality</td>
<td>b) 30-day mortality n (%): 26 (5.5)
c) AUC (95% CI) predicting 30-day mortality:
• PSI: 0.87
d) 30-day mortality
<table>
<tr><th>PSI criteria</th><th>30-day mortality, n</th></tr>
<tr><td>I</td><td>0</td></tr>
<tr><td>II</td><td>0</td></tr>
<tr><td>III</td><td>0</td></tr>
<tr><td>IV</td><td>7</td></tr>
<tr><td>V</td><td>19</td></tr>
<tr><th>CURB65</th><th>30-day mortality, n</th></tr>
<tr><td>0</td><td>0</td></tr>
<tr><td>1</td><td>0</td></tr>
<tr><td>2</td><td>10</td></tr>
<tr><td>3</td><td>8</td></tr>
<tr><td>4</td><td>5</td></tr>
<tr><td>5</td><td>1</td></tr>
</table>
</td>
<td>Funding:
Health research council of New Zealand, Waikato respiratory research fund

Limitations:
Aim of the study was to study the role of NT-proBNP in predicting mortality

Additional outcomes:

Notes:</td>
</tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr><td>(including confounders adjusted for):
ROC analysis</td><td>Pneumonia severity according to PSI and CURB65 criteria
<table><tr><th>PSI criteria</th><th>Patients, n</th></tr><tr><td>I</td><td>69</td></tr><tr><td>II</td><td>65</td></tr><tr><td>III</td><td>90</td></tr><tr><td>IV</td><td>153</td></tr><tr><td>V</td><td>77</td></tr><tr><th>CURB65</th><th>Patients, n</th></tr><tr><td>0</td><td>79</td></tr><tr><td>1</td><td>114</td></tr><tr><td>2</td><td>122</td></tr><tr><td>3</td><td>74</td></tr><tr><td>4</td><td>23</td></tr><tr><td>5</td><td>1</td></tr></table>LOS, mean (SD): 6.7 days</td><td></td><td></td><td></td><td></td></tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
Author and year: Ewig et al. 2004[20] **Study type:** Prospective **Selection / patient setting:** Tertiary care university hospital in Barcelona, Spain Consecutive patients admitted to hospital with a diagnosis of CAP **Addressing missing data/non reliability of data:** **Statistical analysis (including**	**Diagnosis:** CAP was diagnosed based on clinical signs and symptoms, and new infiltrate on CXR **Inclusion criteria:** Patients with a diagnosis of CAP **Exclusion criteria:** Severe immunosuppression Pneumonia as an expected terminal event of a severe chronic disabling comorbidity Alternative diagnosis during follow up **All patients,** N: 731 eligible Exclusions reasons: 14 patients who died of pneumonia as an expected terminal event of a severe chronic disabling comorbidity 21 patients with undocumented treatment **Included** N: 696 **Age, mean (SD):** 67.8 (17.1) **Aged > 65 years, n:** 464 **Gender: male, %:** 66	• PSI • CURB (modified BTS rule): respiratory rate ≥ 30/min, diastolic blood pressure ≤ 60 mmHg, confusion, blood urea nitrogen > 7 mmol/l • CRB (BTS rule II): respiratory rate ≥ 30/min, diastolic blood pressure ≤ 60 mmHg, confusion • modified ATS: at least 2 of the following 3 minor criteria (SBP < 90 mmHg, multilobar involvement, PaO_2/FiO_2 < 250) or 1 of the following 2 major criteria (requirement	Mortality ICU admission	a) Number of patients admitted to ICU, death by PSI class **PSI class** / **ICU admission, n (%)** / **Mortality, n (%)** I: 0 / 0 II: 5 (10) / 1 (2) III: 10 (10) / 3 (3) IV: 40 (21) / 15 (8) V: 35 (31) / 20 (18) b) Number of patients admitted to ICU, death by CURB **CURB** / **ICU admission, n (%)** / **Mortality, n (%)** 0: 7 (3) / 3 (1) 1: 44 (19) / 17(7) 2: 24 (26) / 7 (8) 3: 20 (61) / 13 (39) 4: 3 (38) / 1 (13) c) AUC (95% CI) predicting ICU admission: • PSI: 0.607 (0.607-0.727) • CURB: 0.732 (0.676-0.787) [All other predictive rules were not suitable for this analysis] *d)* Predictive value of different tools for mortality **Severity tool** / **Sensitivity % (95% CI)** / **Specificity % (95% CI)** / **PPV % (95% CI)** / **NPV % (95% CI)** Modified ATS: 94 (82.5-98.7) / 93 (90.6-94.7) / 49 (38.2-59.7) / 99.5 (90.8-	**Funding:** Red Gira ISCIII-03/063 and Red Respira ISCIII-RTIC-03/11 and FISS PI020616 **Limitations** NR **Additional outcomes**: **Notes:** Mortality-time period not reported "Our data do not support the use of a cut off of ≥2 CURB criteria for deciding whether to admit to ICU. "We didn't find clear cut

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr><td>confounders adjusted for): ROC analysis</td><td>Nursing home patients: NR

Comorbidities: NR

Pneumonia severity

PSI was calculated in 489 patients
<table>
<tr><th>PSI class</th><th>Patients, n (%)</th></tr>
<tr><td>I</td><td>34 (7)</td></tr>
<tr><td>II</td><td>50 (10)</td></tr>
<tr><td>III</td><td>98 (20)</td></tr>
<tr><td>IV</td><td>194 (40)</td></tr>
<tr><td>V</td><td>113 (23)</td></tr>
</table>
CURB was calculated in 592 patients
<table>
<tr><th>CURB</th><th>Patients, n (%)</th></tr>
<tr><td>0</td><td>229 (39)</td></tr>
<tr><td>1</td><td>231 (39)</td></tr>
<tr><td>2</td><td>91 (15)</td></tr>
<tr><td>3</td><td>33 (6)</td></tr>
<tr><td>4</td><td>8 (1)</td></tr>
</table>
LOS, mean (SD): 8.8 (8)</td><td>for mechanical ventilation or septic shock)
• alternative ATS: 2 of 6 minor criteria or 1 of 4 major criteria</td><td></td><td>
<table>
<tr><td></td><td></td><td></td><td></td><td>94.7)</td></tr>
<tr><td>CRB (BTS II)</td><td>53 (38.1-67.9)</td><td>83 (80.3-86.2)</td><td>19 (12.6-26.7)</td><td>96 (94.1-97.5)</td></tr>
<tr><td>CURB (modified BTS)</td><td>51 (35.1-67.1)</td><td>80 (76.3-83.1)</td><td>16 (10.1-23.3)</td><td>96 (93.4-97.3)</td></tr>
</table>
e) Predictive value of different tools for ICU admission
<table>
<tr><th>Severity tool</th><th>Sensitivity % (95% CI)</th><th>Specificity % (95% CI)</th><th>PPV % (95% CI)</th><th>NPV % (95% CI)</th></tr>
<tr><td>Modified ATS</td><td>69 (59.7-77.2)</td><td>98 (96.4-98.9)</td><td>87 (78.3-93.1)</td><td>94 (91.8-95.8)</td></tr>
<tr><td>Alternative ATS</td><td>87 (79.2-92.5)</td><td>82 (79.0-95.4)</td><td>49 (42.1-56.4)</td><td>97 (95.0-98.3)</td></tr>
<tr><td>CRB (BTS II)</td><td>44 (5.1-53.9)</td><td>86 (82.7-88.6)</td><td>38 (30.1-47.2)</td><td>89 (85.6-91.1)</td></tr>
<tr><td>CURB (modified BTS)</td><td>48 (37.8-58.3)</td><td>83 (79.2-86.0)</td><td>36 (27.5-44.4)</td><td>89 (85.7-91.6)</td></tr>
</table>
</td><td>offs for mortality risk between CURB classes 1 and 2 and CURB 3 and 4”</td></tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year: Liapikou et al. 2009[31]

Study type:
Prospective

Selection / patient setting:
Tertiary care university hospital in Barcelona, Spain.
Consecutive patients aged>15 years admitted to the ED with a diagnosis of CAP

Addressing missing data/non reliability of data:

Statistical</td>
<td>Diagnosis:
Pneumonia was defined as a new infiltrate on CXR, and clinical signs and symptoms of LRTI

Inclusion criteria:
Patients aged >15 years with a diagnosis of CAP

Exclusion criteria:
Immunosuppression

All patients,
N: 2102 eligible
Exclusions reasons: NR

Included N: 2102

Age, mean (SD):
• ICU patients: 64 (17)
• Non-ICU patients: 67 (18)

Gender: male, n (%):
• ICU patients: 144 (61.28)
• Non-ICU patients: 1147 (61.44)

Nursing home patients: NR

Comorbidities > 10%:</td>
<td>• PSI
• CURB-65
• IDSA/ATS

IDSA/ATS definition of severe CAP: patients who met at least 1 of 2 major severity criteria or 3 of 9 minor severity criteria</td>
<td>30-day in-hospital mortality
ICU admission</td>
<td>a) ICU admission, n (%): 235 (11.18)
b) Mortality at 30 days: 109 (5.19)
c) IDSA/ATS criteria for severe CAP predictive value for ICU admission
<table>
<tr><th colspan="2">Severe CAP IDSA/ATS criteria</th></tr>
<tr><td>Sensitivity %</td><td>71</td></tr>
<tr><td>Specificity %</td><td>88</td></tr>
<tr><td>Positive likelihood ratio</td><td>5.77</td></tr>
<tr><td>Negative likelihood ratio</td><td>0.33</td></tr>
<tr><td>Univariate RR (95% CI)</td><td>17.5 (12.8-23.9)</td></tr>
</table>
d) Univariate association of severity tools with 30-day in-hospital mortality
<table>
<tr><th>Severity tool</th><th>RR (95% CI</th></tr>
<tr><td>Severe CAP IDSA/ATS</td><td>6.8 (4.6-10.1)</td></tr>
<tr><td>PSI</td><td>1.62 (1.35-1.95)</td></tr>
<tr><td>CURB-65</td><td>2.48 (2.06-2.98)</td></tr>
</table>
e) The sensitivity and specificity</td>
<td>Funding:
CibeRes (CB06/06/0028). 2005 Suport als Grups de Recerca 00822, European Respiratory Society Fellowship (AL), Institut d’investigacions Biomediques August Pi I Sunyer

Limitations
• Blood urea nitrogen level was not systematically determined, so serum creatinine level was used as a surrogate
• DNI (do not intubate) decisions were only available for 41% of cases, previous DNI orders may influence the decision for ICU admission
• Variability of clinician’s judgement and constraints on the</td>
</tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr><td>analysis (including confounders adjusted for):
X^2 or Fisher's exact test
Unpaired t test</td><td>
<table>
<tr><th>Comorbidities</th><th>ICU patients</th><th>Non-ICU patients</th></tr>
<tr><td>Chronic heart failure</td><td>41 (18)</td><td>372 (20)</td></tr>
<tr><td>Chronic pulmonary disease</td><td>109 (47)</td><td>834 (45)</td></tr>
<tr><td>Diabetes</td><td>48 (21)</td><td>352 (19)</td></tr>
<tr><td>Neurological disease</td><td>45 (19)</td><td>359 (19)</td></tr>
</table>
Pneumonia severity, mean (SD)
<table>
<tr><th>Severity tool</th><th>ICU patients</th><th>Non-ICU patients</th></tr>
<tr><td>PSI</td><td>120 (38)</td><td>97 (40)</td></tr>
<tr><td>CURB-65</td><td>1.8 (1.0)</td><td>1.2 (1.0)</td></tr>
</table>
LOS, mean days (SD)
• ICU patients: 7.1 (6.5)
• Non-ICU patients: 18.0 (14.8)</td><td></td><td></td><td>of severe CAP IDSA/ATS criteria to predict hospital mortality were 58% and 88%, respectively.</td><td>availability of ICU beds may have influenced decisions on ICU admission

Additional outcomes: Predictive values for each minor and major criteria

Notes:</td></tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
Author and year: Feldman et al. 2009[21] **Study type:** Prospective **Selection / patient setting:** 21 hospitals across 10 countries. Patients diagnosed with bacteraemic pneumococcal pneumonia **Addressing missing data/non reliability of data:** The analysis included 739 patients for whom missing laboratory parameters were considered as normal values. A separate analysis was conducted in 519 patients, excluding	**Diagnosis:** Pneumonia confirmed by CXR associated with pneumococcal bacteraemia **Inclusion criteria:** Patients with a diagnosis of bacteraemic pneumococcal pneumonia **Exclusion criteria:** Patients who also had meningitis (59), endocarditis (7), those with uncertain ICU status (9), and those without evaluation of their mental status (3) **All patients,** N: 844 Exclusions reasons: see exclusion criteria above **Included** N: 766 **Age, mean (SD):** NR **Gender: male, %:** NR **Nursing home patients:** NR	• modified ATS: 2 minor or 1 major criteria • IDSA/ATS: any major or 3 minor • CURB-65: ≥ 3 • CRB 65: ≥ 3 • PSI IV or V	14 day mortality	a) Predictive values for 14 day mortality: **Severity tool** / **Sensitivity %** / **Specificity %** / **PPV %** / **NPV %** Modified ATS: 72.6 / 80.2 / 38.1 / 94.6 IDSA/ATS: 79.2 / 66.0 / 28.1 / 95.0 CURB-65 (≥ 3): 52.8 / 80.1 / 30.8 / 91.0 PSI IV or V: 80.2 / 55.6 / 23.2 / 94.4 b) ROC for 14 days mortality: • modified ATS: 0.7361 • IDSA/ATS: 0.7099 • CURB-65: 0.7365 • PSI: 0.721 c) 14-day mortality (%) by severity **Severity tool** / **Mortality % (n deaths/total)** Modified ATS: 27.5 (544/766) IDSA/ATS: 40.6 (311/766) CURB-65 (≥ 3): 24.6 (183/744) CRB-65 (≥ 3): 9.9 (74/744) PSI IV or V: 49.5 (367/742)	**Funding:** NR **Limitations:** The study population was restricted to patients with pneumococcal bacteraemia, but it was not specified whether patients had CAP. However, *S. pneumonia* is the most common cause of CAP, and the most common pathogen in cases of pneumonia admitted to ICU. **Additional**

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
any patients with missing values for any of the severity tools **Statistical analysis (including confounders adjusted for):** ROC analysis	**Comorbidities:** NR				**outcomes:** **Notes:**

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
Author and year: Spindler et al. 2006[43] **Study type:** Prospective/retrospective **Selection / patient setting:** Karolinska University hospital in Sweden. Consecutive patients (86) with bacteraemic pneumococcal pneumonia, and retrospective review of hospital records of patients with bacteraemic pneumococcal pneumonia (28) **Addressing missing data/non reliability of data:** **Statistical analysis (including confounders adjusted for):** ROC analysis	**Diagnosis:** CAP with positive blood cultures for S pneumoniae and infiltrates on CXR **Inclusion criteria:** Patients with CAP and invasive pneumococcal disease **Exclusion criteria:** Patients who had treatment in hospital within the previous 30 days of admission **All patients,** N: 114 Exclusions reasons: NR **Included** N: 114 **Age, mean (SD):** 57.1 (17.5) **Gender: male, n (%):** 62 (54.4) **Nursing home patients:** NR **Comorbidities > 10%, n (%):** • Chronic heart condition: 27 (23.7) • Chronic lung condition: 12 (8.4) • Cancer: 23 (20.2) • Immunosuppressive treatment: 17	• PSI (≥ IV) • CURB-65 (≥ 3) • modified ATS: > 1 minor or ≥ 1 major criteria	Mortality ICU admission	a) Mortality, n (%): 13 (11.4) b) Mortality AUC • PSI: 0.85 • CURB-65: 0.84 • modified ATS: 0.83 c) Predictive values for mortality **Severity tool** / **Sensitivity %** / **Specificity %** / **PPV %** / **NPV %** PSI IV-V: 100 / 60 / 25 / 100 CURB-65 (3-5): 62 / 86 / 36 / 95 Modified ATS (1 major > 1minor): 85 / 84 / 41 / 98 d) Predictive values for ICU admission **Severity tool** / **Sensitivity %** / **Specificity %** / **PPV %** / **NPV %** PSI IV-V: 95 / 64 / 36 / 98 CURB-65 (3-5): 71 / 87 / 55 / 91 Modified ATS (1 major > 1minor): 90 / 90 / 67 / 98	**Funding:** NR **Limitations** • The study was partly retrospective; however no difference was seen in the number of missing variables in the two patient groups • Time from admission to antibiotic initiation has an impact on mortality but such data were not available • Creatinine levels were used instead of urea levels **Additional outcomes**:

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
	(14.9) **Pneumonia severity** **PSI class** / **Patients, n (%)** I-II: 47 (41.2) III: 14 (12.3) IV: 31 (37.2) V: 22 (19.3) **CURB-65** / **Patients, n (%)** 0: 42 (36.8) 1: 27 (23.7) 2: 23 (20.2) 3: 17 (14.9) 4: 4 (3.5) 5: 1 (0.9) **mATS** / **Patients, n (%)** 0: 72 (63.2) 1 minor: 15 (13.2) >1 minor and/or ≥1 major: 27 (23.7)				**Notes:**

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at hospital admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Angus et al. 2002[4]
Study type:
Prospective

Selection / patient setting:
Inpatients with CAP of the Pneumonia PORT cohort study at 3 US and one Canadian sites

Addressing missing data/non reliability of data:
NR

Statistical analysis (including confounders adjusted for):
• ROC analysis
• Chi statistics of Fisher exact test for categorical variables
• Student t test or Mantel-Cox log rank test for continuous variables</td>
<td>Diagnosis:
CAP diagnosis was based on clinical and CXR evidence of pneumonia within 24 hours of presentation

Inclusion criteria:
Patients with CAP

Exclusion criteria: NR

All patients,
N: 1339
Exclusions reasons: NR

Included N: 1339

Age, mean (SD): NR

Gender: male, n (%): NR

Nursing home patients, n (%): 184 (13.74)

Comorbidities, n (%):
• Chronic pulmonary disease: 451 (33.68)</td>
<td>• PSI
• original ATS: severe CAP is defined by the presence of 1 of 7 risk factors
• revised ATS: severe CAP is defined by the presence of 2 of 3 minor criteria or 1 of 2 major criteria</td>
<td>• 30-day mortality
• ICU admission</td>
<td>a) 30-day mortality, (%): Non-ICU (6.9), ICU (15.3)
b) ICU admission, n (%): 170 (12.7)
c) ATS and PSI prediction for 30-day mortality:
<table>
<tr><th>Severity tools</th><th>Sensitivity %</th><th>Specificity %</th><th>PPV %</th><th>NPV %</th><th>ROC (95% CI)</th><th>RR (95% CI)</th></tr>
<tr><td>ATS original</td><td>79.8</td><td>41.4</td><td>8.8</td><td>96.6</td><td>0.60 (0.54-0.65)</td><td>2.6 (1.5-4.5)</td></tr>
<tr><td>ATS revised</td><td>39.6</td><td>67.6</td><td>8.2</td><td>93.9</td><td>0.63 (0.57-0.69)</td><td>1.3 (0.9-2.1)</td></tr>
<tr><td>PSI IV or V</td><td>94.4</td><td>53.2</td><td>12.6</td><td>99.3</td><td>0.75 (0.71-0.78)</td><td>16.8 (6.8-41.8)</td></tr>
</table>
d) ATS and PSI prediction for ICU admission:
<table>
<tr><th>Severity tools</th><th>Sensitivity %</th><th>Specificity %</th><th>PPV %</th><th>NPV %</th><th>ROC (95% CI)</th><th>RR (95% CI)</th></tr>
<tr><td>ATS original</td><td>81.8</td><td>43.1</td><td>17.3</td><td>94.2</td><td>0.61 (0.57-0.65)</td><td>3.0 (2.0-4.5)</td></tr>
<tr><td>ATS revised</td><td>70.7</td><td>72.4</td><td>26.4</td><td>94.7</td><td>0.68 (0.64-0.73)</td><td>4.9 (3.4-7.1)</td></tr>
<tr><td>PSI IV or V</td><td>72.9</td><td>53.4</td><td>18.5</td><td>90.3</td><td>0.60 (0.56-0.65)</td><td>2.7 (1.9-3.9)</td></tr>
</table>
</td>
<td>Funding:
Agency for Healthcare Policy and Research, National Institute of Medical Sciences, and unrestricted educational grant from Amgen

Limitations:
• Data from the cohort were collected in the early and mid 1990s, so care patters may not be representative of current care
• There is no gold standard for the term</td>
</tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
	• Coronary artery disease: 349 (26.06) • Congestive heart failure: 225 (16.80) • Renal disease: 139 (10.38) • Dementia: 133 (9.93) **Pneumonia severity:** **PSI class** / **Patients, n (%)** I: 184 (13.7) II: 233 (17.4) III: 253 (18.9) IV: 446 (33.3) V: 223 (16.6) **LOS, median (range):** NR **DNR order, n (%):** 199 (14.8)				"severe CAP" and the definitions used are arbitrary **Additional outcomes**:

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
Author and year: Valencia et al. 2007[45] **Study type:** Prospective **Selection / patient setting:** One tertiary hospital in Barcelona, Spain. Consecutive patients with CAP and PSI-V (PSI ≥ 130) on admission **Addressing missing data/non reliability of data:** NR **Statistical analysis (including**	**Diagnosis:** CAP was defined as symptoms of lower respiratory tract infection plus new infiltrates seen on a CXR and the absence of an alternative diagnosis **Inclusion criteria:** Patients with CAP and PSI-V on admission **Exclusion criteria:** Patients with a hospital admission in the previous month or those who had received antibiotic IV treatment. Also, those patients receiving chemotherapy and inmunocompromised patients **All patients,** N: 457 Exclusions reasons: NR **Included** N: 457	• CURB • CURB-65 • modified ATS: includes 2 major criteria (mechanical ventilation and shock) or 2 of 3 minor criteria • PSI-V (acute PSI)	• Hospital mortality • ICU admission	a) Hospital mortality, n (%): 107 (23) b) ICU admission, n (%): 92 (20) c) Predictive value of severity tools for hospital mortality: **Severity tools** / **Sensitivity %** / **Specificity %** / **PPV %** / **NPV %** CURB / 72 / 42 / 24 / 86 Modified ATS / 72 / 77 / 44 / 91 CURB-65 / 60 / 44 / 21 / 81 PSI-V / 80 / 57 / 32 / 92 d) Predictive value of severity tools for ICU admission: **Severity tools** / **Sensitivity %** / **Specificity %** / **PPV %** / **NPV %** CURB / 78 / 45 / 30 / 87 Modified ATS / 73 / 48 / 30 / 85 CURB-65 / 75 / 80 / 53 / 91 PSI-V / 71 / 56 / 33 / 86	**Funding:** Fondo de Investigaciones Sanitarias grant 02/0632, and Institut de Investigacions Biomediques August Pi i Sunyer grant 2005 SGRQ/00822, and Centro de Investigacion Biomedica en Red-Enfermedades Respiratorias CB 06/06/0028. Dr Mauricio Valencia received a research fellowship grant in 2002 funded by the European Respiratory Society. **Limitations** • Despite the use of severity scores, ICU admission decisions are still based mainly on the clinical judgment of the attending physicians. • It is very possible that the study cohort includes some patients who would now be classified as having health-care-associated pneumonia (HCAP). The study was carried out before the definition of this category in the ATS consensus statement was published in 2005 **Additional outcomes**: **Notes:**

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
confounders adjusted for): ROC analysis	**Age, mean (SD):** 79 (11) **Gender: male, n (%):** 320 (70) **Nursing home patients, n (%):** 68 (14.8) **Comorbidities (>10%), n (%):** • Any pulmonary disease: 277 (60) • COPD: 181 (39.6) • Heart disease: 166 (36) • Neurologic disorder: 133 (29) • Chronic renal disease: 115 (25) • Diabetes: 70 (15.3) • Malignancy: 90 (19.7) **Pneumonia severity, mean (SD):** PSI: 154 (20) points **LOS, median (range):** NR				[A very significant proportion of hospitalized patients with CAP belong to PSI-V; while the mortality risk in this group was high, relatively few patients were admitted to the ICU because the PSI classification identified a very heterogeneous group of patients, many of whom did not have severe acute illness]

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at ICU admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Belkhouja et al. 2012[8]
Study type:
Retrospective

Selection / patient setting:
One hospital in Tunisia.
Consecutive patients with CAP admitted to the ICU with severe pneumoccocal pneumonia

Addressing missing data/non reliability of data:
NR

Statistical analysis (including</td>
<td>Diagnosis:
CAP was defined as acute symptoms of lower respiratory tract infection plus new infiltrates seen on a CXR at hospital admission

Inclusion criteria:
Patients with CAP positive for S. pneumoniae

Exclusion criteria:
Aged<15 years, severe immunosuppression

All patients,
N: 273
Exclusions reasons: Non pneumococcal pneumonia

Included N: 132

Age, mean (SD): 49.5 (21.6)

Gender: male, n (%): 109 (82.5)</td>
<td>• SOFA
• CURB-65
• PSI</td>
<td>• ICU mortality</td>
<td>a) ICU mortality, n (%): 107 (23)

a) Univariate analysis of continuous variables:

<table>
<tr><th>Severity score</th><th>Dead (median, range)</th><th>Alive (median, range)</th><th>p value</th></tr>
<tr><td>SOFA</td><td>6 (1-14)</td><td>2 (0-22)</td><td>< 0.001</td></tr>
<tr><td>CURB-65</td><td>3 (2-5)</td><td>2 (0-5)</td><td>< 0.001</td></tr>
</table>

b) Univariate analysis of categorical variables:
PSI ≥ IV: OR for mortality = 13.6 (95% CI 3.88-47.46, p < 0.001)

c) Multivariate analysis of factors predicting ICU mortality:

The need for mechanical ventilation at ICU admission, SOFA ≥ 4 and serum creatinine ≥ 102µmol/l were the only independent factors associated with mortality
• SOFA ≥ 4: OR for mortality = 3.1 (95% CI 1.56-6.13, p = 0.001)

[All the statistically significant variables in the univariate analysis were included in the multiple logistic regression analysis model with a stepwise forward selection: age, SAPSII, SOFA at admission, CURB-65, serum glucose at</td>
<td>Funding:
NR

Limitations:
• Retrospective study
• Study period is very wide (1999-2008)
• Single centre study

Additional outcomes:
Simplified acute physiology score II (SAPSII), Glasgow coma score (GCS)
Notes:
Severe CAP</td>
</tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
confounders adjusted for): • Categorical variables– chi squared test of Fisher's exact test • Continuous variables – Student's t test or Mann-Whitney U test	**Nursing home patients, n (%):** NR **Comorbidities, n (%):** • Any pulmonary disease: 67 (54.5) • COPD: 51 (38.6) • Heart disease: 27 (20.5) • Diabetes: 21 (16) **Pneumonia severity, mean (SD)/median (range):** • SOFA: 2 (0-22) •CURB-65: 2 (0-5) • PSI II and III: 60 (45.5) • PSI IV: 35 (26.5) • PSI V: 37 (28) **LOS in ICU, median (range):** 9.5 (1-68) days			admission, serum creatinine at admission, arterial pH at admission, PaO_2/FiO_2 at admission, PSI ≥ IV, heart disease, COPD, diabetes, bilateral pneumonia, multilobar pneumonia, septic shock at admission, acute lung injury/acute respiratory distress syndrome at admission, multiple organ failure at admission, mechanical ventilation required at admission]	

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Guo et al. 2012[24]
Study type:
Retrospective

Selection / patient setting:
One teaching hospital in China.
Adults admitted to hospital with a diagnosis of CAP

Addressing missing data/non reliability of data:
NR

Statistical</td>
<td>Diagnosis:
CAP diagnosis was based on infiltrate on CXR and two or more clinical symptoms (fever, hypothermia, rigors, sweats, new cough or change in colour or respiratory secretions, dyspnoea)

Inclusion criteria:
All patients had CXR or CT scans.

Exclusion criteria:
Age < 18 years, hospitalised in the previous 28 days, HIV-related disorders, active tuberculosis, concurrent infectious disease, end – stage diseases, or patients with written DNR orders

All patients,
N: 1245
Exclusions reasons: NR

Included N: 1230</td>
<td>• CURB-65
• IDSA/ATS minor criteria</td>
<td>Hospital mortality</td>
<td>a) Hospital mortality , n (%); 16 (1.3)

b) Predictive value for hospital mortality by CURB-65 and IDSA/ATS minor criteria
<table>
<tr><th>Severity</th><th>Mortality, n (%)</th><th>Sensitivity (%)</th><th>Specificity (%)</th><th>PPV (%)</th><th>NPV (%)</th></tr>
<tr><td colspan="6">CURB-65</td></tr>
<tr><td>CURB-65 ≥ 0</td><td>0 (0)</td><td>100</td><td>0</td><td>1.3</td><td>0</td></tr>
<tr><td>CURB-65 ≥ 1</td><td>4 (1)</td><td>100</td><td>59</td><td>3.1</td><td>100</td></tr>
<tr><td>CURB-65 ≥ 2</td><td>8 (8.2)</td><td>75</td><td>91.8</td><td>10.7</td><td>99.6</td></tr>
<tr><td>CURB-65 ≥ 3</td><td>2 (16.7)</td><td>25</td><td>99.2</td><td>28.6</td><td>99</td></tr>
<tr><td>CURB-65 ≥ 4</td><td>2 (100)</td><td>12.5</td><td>100</td><td>100</td><td>98.9</td></tr>
<tr><td colspan="6">IDSA/ATS minor criteria</td></tr>
<tr><td>IDSA/ATS minor criteria ≥ 0</td><td>2 (0.3)</td><td>100</td><td>0</td><td>1.3</td><td>0</td></tr>
<tr><td>IDSA/ATS minor criteria ≥ 1</td><td>4 (1)</td><td>87.5</td><td>53.7</td><td>2.4</td><td>99.7</td></tr>
<tr><td>IDSA/ATS minor criteria ≥ 2</td><td>4 (3.3)</td><td>62.5</td><td>86.5</td><td>5.7</td><td>99.4</td></tr>
<tr><td>IDSA/ATS minor criteria ≥ 3</td><td>4 (10.5)</td><td>37.5</td><td>96</td><td>11.1</td><td>99.1</td></tr>
<tr><td>IDSA/ATS minor criteria ≥ 4</td><td>0 (0)</td><td>12.5</td><td>98.8</td><td>12.5</td><td>98.8</td></tr>
<tr><td>IDSA/ATS minor criteria ≥ 5</td><td>2 (50)</td><td>12.5</td><td>99.8</td><td>50</td><td>98.9</td></tr>
</table>
</td>
<td>Funding:
Medical science and technology foundation of Guandong province in 2010, the planned science and technology project of Shenzhen municipality in 2011, and the non-profit scientific research project of Futian district in 2011

Limitations
• Retrospective single-centre study

Additional outcomes:
[The number of</td>
</tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
analysis (including confounders adjusted for): ROC analysis	**Age, mean (SD):** 47.5 (22.2) **Gender: male, (%):** (49.3) **Nursing home patients, n (%):** NR **Comorbidities, n (%):** NR **Pneumonia severity:** **Tool** / **N patients (%)** **CURB-65** 0: 716 (0)58.2 1: 402 (32.7) 2: 98 (8.0) 3: 12 (1.0) 4: 2 (0.2) **IDSA/ATS minor criteria** 0: 654 (53.2) 1: 402 (1) 2: 4 (3.3) 3: 4 (10.5) 4: 0 (0) 5: 2 (50) **LOS, median (range):** NR				CURB-65 criteria present had a significant increased OR for mortality of 7.547 (95% CI 4.126-13.805, p<0.001] Not clear what the comparison is **Notes:**

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools on admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Capelastegui et al. 2006[13]
Study type:
Prospective

Selection / patient setting:
Galdakao teaching hospital, Basque Country, Spain
Consecutive cohort of adults admitted to the ED of the Galdakao hospital with a diagnosis of CAP

Addressing missing data/non reliability of data:
Data were missing for>1% of patients for all variables

Statistical analysis (including confounders adjusted for):
ROC analysis</td>
<td>Diagnosis:
Pneumonia was defined as pulmonary infiltrates on CXR and clinical symptoms consistent with pneumonia (cough, dyspnoea, fever, and/or pleuritic chest pain)

Inclusion criteria:
Adults (≥ 18 years) with a diagnosis of CAP

Exclusion criteria:
HIV-positive, chronically immunosuppressed, hospitalised in the previous 14 days

All patients,
N: 1776
Exclusions reasons: NR

Included N: 1776

Age, mean (SD): 61.8 (20.5)
Age ≥ 65 years, n (%): 973 (54.8)

Gender: male, n (%): 1124 (6.33)

Nursing home patients, n (%): 102 (5.7)</td>
<td>• PSI
• CURB-65
• CRB-65</td>
<td>30-day mortality</td>
<td>a) 30-day mortality, n (%): 119 (6.7)
b) AUC (95% CI) predicting 30-day mortality:
• PSI: 0.888 (0.864-0.912)
• CURB-65: 0.870 (0.844-0.895)
• CRB-65: 0.864 (0.835-0.892)
c) 30-day mortality by severity tool % (deaths/total)

<table>
<tr><th>Severity tool</th><th>Mortality % (death/total)</th></tr>
<tr><th colspan="2">CURB-65</th></tr>
<tr><td>0</td><td>0 (0/629)</td></tr>
<tr><td>1</td><td>1.1 (4/377)</td></tr>
<tr><td>2</td><td>7.6 (36/474)</td></tr>
<tr><td>3</td><td>21 (47/224)</td></tr>
<tr><td>4</td><td>41.9 (26/62)</td></tr>
<tr><td>5</td><td>60 (6/10)</td></tr>
<tr><th colspan="2">CRB-65</th></tr>
<tr><td>0</td><td>0 (0/716)</td></tr>
<tr><td>1</td><td>4.1 (28/686)</td></tr>
<tr><td>2</td><td>18.7 (55/294)</td></tr>
<tr><td>3</td><td>43.5 (30/69)</td></tr>
<tr><td>4</td><td>54.6 (6/11)</td></tr>
</table>
</td>
<td>Funding:
NR

Limitations:
CURB-65 was not assessed as a tool for admission criteria

Additional outcomes:
Need for mechanical ventilation was measured [n (%): 18 (1)], but AUC was only reported for 30-day mortality

Notes:</td>
</tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools on admission (including thresholds used)	Outcomes measures	Results	Comments
	Comorbidities, n (%): Neoplastic disease: 72 (4.1) Liver disease: 62 (3.5) Congestive heart failure: 101 (5.7) Cerebrovascular disease: 144 (8.1) Renal disease: 115 (6.5) **Pneumonia severity, n (%):** PSI I: 520 (29.3) PSI II: 287 (16.2) PSI III: 338 (19) PSI IV: 438 (24.7) PSI V: 193 (10.9) **LOS, mean (SD):** 5.1 (4.3)				

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools on admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr><td rowspan="3">Author and year:
Chalmers et al. 2008[14]
Study type:
Prospective

Selection / patient setting:
NHS Lothian University Hospitals Division, A&E or medical assessment units.
Either self-referral to A&E or GP referral to the medical assessment unit

Addressing missing data/non reliability of data: NR

Statistical analysis (including confounders adjusted for):
ROC analysis</td><td rowspan="3">Diagnosis:
Pneumonia was defined as pulmonary infiltrates on CXR and ≥ 3 clinical symptoms (cough, sputum production, breathlessness, fever, pleuritic chest pain, haemoptysis, headache, signs of pneumonia on chest auscultation)

Inclusion criteria:
Diagnosis of CAP

Exclusion criteria:
HAP, active malignancy, immunosuppression, pulmonary embolism, patients receiving palliative care

All patients,
N: 1007

Included N: 1007

Age, mean (range): 66 (50-78)

Gender: male (%): (49.7)

Nursing home patients: NR

Comorbidities, (%):
Chronic cardiac failure (20)</td><td rowspan="3">• CURB-65
• CRB-65</td><td rowspan="3">30-day mortality</td><td>30-day mortality: 9.6%</td><td rowspan="3">Funding:
NR

Limitations:
NR

Additional outcomes:
Hypertension, hypotension as prognostic factors for 30-day mortality (OR)

Notes:</td></tr>
<tr><td>AUC (95% CI) predicting 30-day mortality:
• CURB-65: 0.76 (0.74-0.79)
• CRB-65: 0.74 (0.71-0.77)</td></tr>
<tr><td>Prediction of 30 day mortality:

<table><tr><th>Severity tool</th><th>Sensitivity %</th><th>Specificity %</th><th>PPV %</th><th>NPV %</th></tr><tr><td>CURB-65</td><td>70.1</td><td>80.4</td><td>20.9</td><td>95.7</td></tr><tr><td>CRB-65</td><td>47.4</td><td>87.4</td><td>28.6</td><td>94.0</td></tr></table></td></tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools on admission (including thresholds used)	Outcomes measures	Results	Comments
	Cerebrovascular disease (11.6) Diabetes mellitus (10.1) COPD (20.6) **Pneumonia severity, n (%):** NR **LOS:** NR				

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools on admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Zuberi et al. 2008[49]
Study type:
Prospective

Selection / patient setting:
Tertiary care Aga Khan University hospital in Karachi, Pakistan. Patients admitted to the emergency department

Addressing missing data/non reliability of data:

Statistical analysis (including</td>
<td>Diagnosis:
CAP was defined as clinical and CXR evidence of acute lung parenchymal infection on admission that was not pre-existing or of any other known cause in a patient not hospitalised for more than 14 days before the onset of symptoms

Inclusion criteria:
Patients (≥ 16 years) admitted to the ED with a diagnosis of CAP

Exclusion criteria:
Pneumonia was not the primary cause of hospital admission, post-obstructive pneumonia, tuberculosis, bronchiectasis, solid organ and haematological malignancies, HIV-infection, immunocompromised patients, nursing home residents

All patients,</td>
<td>• CURB-65
Low – 0-1
Intermediate – 2
High – 3-5
• CRB-65
Low – 0
Intermediate – 1-2
High – 3-4</td>
<td>30-day mortality</td>
<td>AUC (95% CI) predicting 30-day mortality:
• CURB-65: 0.863
• CRB-65: 0.835

a) Number of patients in each score and 30-day mortality
<table>
<tr><th>Risk score</th><th>Number of patients, n (%) N = 137</th><th>30 day mortality, n (%) N = 18</th></tr>
<tr><td>CURB-65 0</td><td>26 (19)</td><td>0</td></tr>
<tr><td>CURB-65 1</td><td>37 (27)</td><td>0</td></tr>
<tr><td>CURB-65 2</td><td>38 (27.7)</td><td>4 (10.5)</td></tr>
<tr><td>CURB-65 3</td><td>29 (21.2)</td><td>11 (37.9)</td></tr>
<tr><td>CURB-65 4</td><td>6 (4.4)</td><td>2 (33.3)</td></tr>
<tr><td>CURB-65 5</td><td>1 (0.7)</td><td>1 (100)</td></tr>
<tr><td colspan="3">P value (df = 5) < 0.0001</td></tr>
<tr><td>CRB-65 0</td><td>34 (24.8)</td><td>0</td></tr>
<tr><td>CRB-65 1</td><td>55 (40.1)</td><td>3 (5.5)</td></tr>
<tr><td>CRB-65 2</td><td>39 (28.5)</td><td>10 (25.6)</td></tr>
<tr><td>CRB-65 3</td><td>8 (5.8)</td><td>4 (50)</td></tr>
<tr><td>CRB-65 4</td><td>1 (0.7)</td><td>1 (100)</td></tr>
<tr><td colspan="3">P value (df = 4) < 0.0001</td></tr>
</table>
b) Correlation of 30 day mortality with severity risk groups
<table>
<tr><th colspan="2">Mortality risk groups</th><th>30-day mortality in hospital, n N = 15</th><th>30 day mortality after discharge, n N = 3</th><th>OR (95% CI)</th></tr>
<tr><td rowspan="2">CURB65</td><td>Low (0-1)</td><td>0</td><td>0</td><td rowspan="2">Ref.group</td></tr>
<tr><td>Intermediate</td><td>1</td><td>3</td></tr>
</table>
</td>
<td>Funding:
NR

Limitations:
• Small number of patients in the high-risk levels of both scores
• Recruitment of inpatients who generally have poorer health than outpatients might have introduced bias

Additional outcomes:

Notes:</td>
</tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools on admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr><td>confounders adjusted for):
ROC analysis
Fisher’s exact test</td><td>N: 155
Exclusions reasons: Status (dead or alive 30 days after admission) not available

Included N: 137

Age, mean (SD): 60.4 (18.5)
Age ≥ 65 years, n (%): 65 (47.7)</td><td></td><td></td><td>
<table>
<tr><td></td><td>(2)</td><td></td><td></td><td></td></tr>
<tr><td></td><td>High (3-4)</td><td>14</td><td>0</td><td>15.4 (4.6-51.4)</td></tr>
<tr><td>CRB65</td><td>Low (0-1)</td><td>0</td><td>0</td><td rowspan="2">Ref.group</td></tr>
<tr><td></td><td>Intermediate (2)</td><td>10</td><td>3</td></tr>
<tr><td></td><td>High (3-4)</td><td>5</td><td>0</td><td>11.1 (2.6-46.4)</td></tr>
</table>
</td><td></td></tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools on admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr><td></td><td>Gender: male, n (%): 74 (54)

Nursing home patients: excluded

Comorbidities >10%, n (%):
• Diabetes mellitus: 61 (44.5)
• Ischaemic heart disease/chronic heart failure: 48 (35.0)
• COPD: 28 (20.4)
• Chronic renal failure: 20 (14.6)

Pneumonia severity, n (%): NR

LOS: NR</td><td></td><td></td><td>c) Sensitivity, specificity, positive and negative predictive values of the prediction rules

<table>
<tr><th>Severity tool</th><th>Sensitivity %</th><th>Specificity %</th><th>PPV %</th><th>NPV %</th></tr>
<tr><th colspan="5">CURB-65</th></tr>
<tr><td>≥0</td><td>100</td><td>0</td><td>12.7</td><td>NC</td></tr>
<tr><td>≥1</td><td>100</td><td>22</td><td>16</td><td>NC</td></tr>
<tr><td>≥2</td><td>100</td><td>53</td><td>24</td><td>100</td></tr>
<tr><td>≥3</td><td>78</td><td>82</td><td>38</td><td>96</td></tr>
<tr><td>≥4</td><td>17</td><td>97</td><td>42</td><td>88</td></tr>
<tr><td>5</td><td>6</td><td>100</td><td>100</td><td>87</td></tr>
<tr><th colspan="5">CRB-65</th></tr>
<tr><td>≥0</td><td>100</td><td>0</td><td>13</td><td>NC</td></tr>
<tr><td>≥1</td><td>100</td><td>29</td><td>17</td><td>NC</td></tr>
<tr><td>≥2</td><td>83</td><td>72</td><td>31</td><td>96</td></tr>
<tr><td>≥3</td><td>28</td><td>97</td><td>55</td><td>89</td></tr>
<tr><td>4</td><td>6</td><td>100</td><td>100</td><td>87</td></tr>
</table>
NC= non-calculable</td><td></td></tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Bauer et al. 2006[7]
Study type:
Prospective, multicentre
Selection / patient setting:
Ten clinical centres across Germany, including hospitals and out-patient departments. Consecutive patients presenting with CAP
Addressing missing data/non reliability of data:
Statistical analysis (including</td>
<td>Diagnosis: Pneumonia defined as new CXR pulmonary infiltrates and at least one clinical symptom (cough, dyspnoea, fever, purulent sputum, focal chest signs, pleuritic chest pain)
Inclusion criteria: Patients with a diagnosis of CAP
Exclusion criteria: Acquisition of pneumonia after hospital admission, severe immunosuppression, pneumonia as an expected terminal event of a severe chronic disabling comorbidity, alternative diagnosis evolving during follow-up
All patients, N: 2363; 538 outpatients, 1646 hospitalised
Exclusion reasons: 179 patients could not be contacted 14 days after inclusion in the study
Included N: 2184
Age, mean (SD): Outpatients (OP); Inpatients (IP)
- OP: 53 (17); IP: 66 (18)
Gender: male, n (%): OP: 250 (47); IP: 986 (60)
Nursing home patients, n (%): NR
Comorbidities > 5%, n (%):
Neoplastic disease: OP: 39 (7); IP: 189 (12)
Chronic heart failure: OP: 36 (7); IP: 447 (28)
Diabetes mellitus: OP: 45 (8); IP: 347 (21)
Renal disease: OP: 11 (2); IP: 172 (11)
Cerebrovascular disease: OP: 22 (4); IP: 275 (17)
Pulmonary disease: OP: 163 (31); IP: 600 (37)
Pneumonia severity, n (%):
<table>
<tr><th>Risk categories</th><th>CURB</th><th>CRB</th><th>CRB-65</th></tr>
</table>
</td>
<td>• CURB
• CRB
• CRB-65</td>
<td>30-day mortality</td>
<td>a) 30-day mortality: 4.3%
b) AUC (95% CI) predicting 30-day mortality:
• CURB: 0.793 (0.745-0.841)
• CRB: 0.721 (0.654-0.787)
• CRB-65: 0.785 (0.736-0.833)

c) Mortality at 30 days according to CURB, CRB and CRB-65 for patients with all data sets complete:
<table>
<tr><th></th><th>Outpatients, N = 208</th><th>Inpatients, N = 1135</th></tr>
<tr><th colspan="3">CURB</th></tr>
<tr><td>0</td><td>0/141</td><td>2/399</td></tr>
<tr><td>1</td><td>0/56</td><td>23/450</td></tr>
<tr><td>2</td><td>1/9</td><td>28/234</td></tr>
<tr><td>3</td><td>1/2</td><td>11/45</td></tr>
<tr><td>4</td><td>nr</td><td>2/7</td></tr>
<tr><th colspan="3">CRB</th></tr>
<tr><td>0</td><td>0/165</td><td>17/645</td></tr>
<tr><td>1</td><td>1/37</td><td>30/402</td></tr>
<tr><td>2</td><td>1/5</td><td>16/78</td></tr>
<tr><td>3</td><td>nr</td><td>3/10</td></tr>
<tr><th colspan="3">CRB65</th></tr>
<tr><td>0</td><td>0/115</td><td>0/268</td></tr>
<tr><td>1</td><td>0/80</td><td>21/524</td></tr>
<tr><td>2</td><td>1/10</td><td>31/283</td></tr>
<tr><td>3</td><td>1/3</td><td>12/53</td></tr>
<tr><td>4</td><td>nr</td><td>2/7</td></tr>
</table>
</td>
<td>Funding:
German Ministry of Education and Research. Dr Bauer was supported by official grants of the Ruhr-University Bochum

Limitations:
• Potential selection bias could have influenced the observed Mortality and the ratio of in- and outpatients might not be representative
• Missing data, however authors are confident on the validity of the results</td>
</tr>
</table>

confounders adjusted for): ROC analysis	0	540	10	63							**Additional outcomes**: **Notes:**
	1	506	83	293							
	2	243	440	604							
	3 or 4	54	810	383							
	LOS, mean (SD): NR										

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools (including thresholds used)</th><th>Outcomes measures</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Varshochi 2013[46]

Study type:
Prospective study during a period of 21 months

Selection / patient setting: Two educational hospital centers in Iran(Imam Reza and Sina in Tabriz)

Addressing missing data/non reliability of data:

Statistical analysis (including confounders adjusted for):</td>
<td>Inclusion criteria:
Patients with CAP; acute respiratory symptoms (cough, sputum, fever and dyspnoea), physical exam findings (percussion dullness, crackle, evidence of consolidation) and radiologic findings in favour of pneumonia.

Exclusion criteria:
Pulmonary embolism, pulmonary cancer, decompounded congestive heart failure, pulmonary oedema, and if they were diagnosed before or during hospital stay.

All patients,
N: 134
Exclusions reasons: NR

Included N: 134

Age, mean (SD): 64.2 (19.8%)
Age ≥ 65 years, n (%): 58 (43.3%)

Gender: male, n (%): 87 (64.9%)

Nursing home patients, n (%): 2 (1.5%)

Comorbidities, n (%):
Altered mental status: 35 (26.1)
Liver disease: 1 (0.7)
Congestive heart failure: 48 (35.8)
Cerebrovascular disease: 25 (18.7)</td>
<td>• PSI (I to V)
• CURB-65 (0 to 5) (collected upon admission)</td>
<td>In hospital mortality: 35 (26.1%)

Results
Mortality rates based on PSI and CURB-65 classifications

<table>
<tr><th>PSI score</th><th>Mortality</th><th>P value</th><th>AUC (95% CI)</th></tr>
<tr><td>I and II (n = 22)</td><td>0 (0)</td><td><0.001</td><td>0.77 (0.69-0.85)</td></tr>
<tr><td>III (n = 21)</td><td>2 (9.5)</td><td></td><td></td></tr>
<tr><td>IV (n = 40)</td><td>8 (20)</td><td></td><td></td></tr>
<tr><td>V (n = 51)</td><td>25 (49)</td><td></td><td></td></tr>
</table>

<table>
<tr><th>CURB 65 score</th><th>Mortality</th><th>P value</th><th>AUC (95% CI)</th></tr>
<tr><td>0 and 1 (n = 22)</td><td>3 (13.6)</td><td>< 0.001</td><td>0.74 (0.65-0.84)</td></tr>
<tr><td>2 (n = 52)</td><td>3 (5.8)</td><td></td><td></td></tr>
<tr><td>3 (n = 43)</td><td>21 (48.8)</td><td></td><td></td></tr>
<tr><td>4 & 5 (n = 17)</td><td>8 (47.1)</td><td></td><td></td></tr>
</table>
Data are shown as frequencies (%)

<table>
<tr><th></th><th>Sensitivity</th><th>Specificity</th></tr>
<tr><td>PSI ≥ IV</td><td>80</td><td>66.7</td></tr>
<tr><td>CURB-65 ≥ 2</td><td>82.9</td><td>68.7</td></tr>
</table>
</td>
<td>Funding:
Supported by Research Center of Infectious Diseases and Tropical Medicine, Tabriz University of Medical Sciences, Tabriz, Iran

Limitations:

No definition of CAP was given

Notes:</td>
</tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools (including thresholds used)	Outcomes measures	Comments
	Renal disease: 43 (32.1) Malignancy: 16 (11.9) Pleural effusion: 24 (17.9) Using mechanical ventilation: 39 (29.1) **Pneumonia severity, n (%):** PSI I: 4 (3) PSI II: 18 (13.4) PSI III: 21 (15.7) PSI IV: 40 (29.9) PSI V: 51 (38.1) **Hospitalization duration (days):** 9.33 (5.24)			

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools (including thresholds used)</th><th>Outcomes measures</th><th>Comments</th></tr>
<tr>
<td>Author and year: Luque 2012[32]
Study type:
Prospective study

Selection / patient setting: all consecutive patients hospitalized with CAP during 2009 in a tertiary hospital in Barcelona

Addressing missing data/non reliability of data:

Statistical analysis (including confounders adjusted for):</td>
<td>Inclusion criteria:
Patients with CAP; presence of respiratory signs and symptoms (dry or conducive cough, pleural pain or dyspnoea), fever, auscultatory findings of abnormal breath sounds and crackles, together with the identification of an infiltrate on the chest X ray .

Exclusion criteria:
Paediatric patients, immunosuppressed subjects (those with HIV or patients receiving chemotherapy) and patients directly admitted to ICU, patients with clinical confirmation of an alternative diagnosis other than pneumonia, or the administration of an antibiotic treatment different from the protocol in the centre (a third generation cephalosporin associated to macrolide drug).

All patients,
N: 152
Exclusions reasons: NR

Included N: 134

Age, mean (SD): 73 (70.6-75.4)</td>
<td>• PSI (I to V)
• CURB-65 (0 to 5) (collected upon admission)</td>
<td>30 day mortality: 18 (11.8%)
In hospital mortality: 20 (13.2%)

Results
30-day mortality rates based on PSI and CURB-65 classifications

<table>
<tr><th>PSI score</th><th>Mortality</th><th>P value</th><th>AUC (95% CI)</th></tr>
<tr><td>I and II (n = 10)</td><td>0 (0)</td><td rowspan="4">0.017</td><td>0.71 (0.59-0.84)</td></tr>
<tr><td>III (n = 28)</td><td>1 (3.6)</td><td rowspan="3"></td></tr>
<tr><td>IV (n = 62)</td><td>6 (9.7)</td></tr>
<tr><td>V (n = 52)</td><td>11 (21.2)</td></tr>
</table>

<table>
<tr><th>CURB 65 score</th><th>Mortality</th><th>P value</th><th>AUC (95% CI)</th></tr>
<tr><td>0 and 1 (n = 47)</td><td>2 (4.2)</td><td rowspan="4">< 0.001</td><td>0.74 (0.62-0.87)</td></tr>
<tr><td>2 (n = 46)</td><td>3 (6.5)</td><td rowspan="3"></td></tr>
<tr><td>3 (n = 35)</td><td>5 (14.3)</td></tr>
<tr><td>4 & 5 (n = 24)</td><td>8 (33.3)</td></tr>
</table>
Data are shown as frequencies (%)

<table>
<tr><th></th><th>Sensitivity</th><th>Specificity</th></tr>
<tr><td>PSI ≥ IV (Fine et al defining low CAP (I-III) and</td><td>0.944</td><td>0.269</td></tr>
</table>
</td>
<td>Funding: Supported by Research Center of Infectious Diseases and Tropical Medicine, Tabriz University of Medical Sciences, Tabriz, Iran

Limitations:

Notes: the study also compared the ability of Mortality Probability Model II (MPM-II) to predict mortality in CAP patients</td>
</tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools (including thresholds used)	Outcomes measures			Comments
	Gender: male, n (%): 105 (69.1%) **Nursing home patients, n (%):**15 (10.3%) **Comorbidities, n (%):** Cardiovascular: 73 (48) COPD or asthma: 62 (40.8) Diabetes mellitus: 32 (21.1) Renal disease: 36 (23.7) Neurological disease: 32 (21.1) Hepatobiliary disease: 15 (9.9) **Pneumonia severity, n (%):** PSI I: 7 (4.6) PSI II: 3 (2) PSI III: 28 (18.4) PSI IV: 62 (40.8) PSI V: 52 (34.1) **Length of hospital stay (days):** 13 (11.6-14.4)		high risk (IV-V)			
			CURB-65 ≥ 2 (Lim et al defining low CAP (0 and 1) or high risk (2-5)	0.889	0.336	

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools (including thresholds used)</th><th>Outcomes measures</th><th>Comments</th></tr>
<tr>
<td>Author and year: Aujesky 2005A[5]
Study type:
Prospective study

Selection / patient setting: all eligible patients hospitalized with CAP from 32 hospital emergency departments (ED) (January- December 2001) in Pennsylvania and Connecticut.

Addressing missing data/non reliability of data:

Statistical analysis (including confounders adjusted for):</td>
<td>Inclusion criteria:
Patients > 18 years old with a clinical diagnosis of pneumonia and a new radiographic infiltrate.

Exclusion criteria:
Patients with hospital-acquired pneumonia, immunosuppression or comorbid conditions that distinguished them diagnostically or therapeutically from pneumonia, or psychosocial problems incompatible with outpatient treatment, enrolment or follow up, pregnant, previously enrolled or enrolled in a competing research.

All patients,
N: 3181
Exclusions reasons: NR

Included N: 3181
Age≥65 years, n (%): 1747 (55%)

Gender: male, n (%): 1540 (48.4%)

Nursing home patients, n (%): 130 (4%)

Comorbidities, n (%):
Congestive heart failure: 431 (14)
Cerebrovascular disease: 268 (8)
Malignancy: 87 (3)</td>
<td>• PSI (I to V)
• CURB
• CURB-65 (0 to 5) (collected upon admission or the first available measurement after the time of presentation to ED)</td>
<td>30 day mortality: 145 (4.6%)

Results
30-day mortality rates based on PSI and CURB-65 classifications
<table>
<tr><th>PSI score</th><th>Mortality</th><th>Likelihood ratio (95% CI)</th><th>AUC (95% CI)</th></tr>
<tr><td>I (n = 686)</td><td>2 (0.3)</td><td>0.06 (0.03-0.2)</td><td></td></tr>
<tr><td>II (n = 774)</td><td>3 (0.4)</td><td>0.08 (0.03-0.3)</td><td>0.81 (0.78-0.84)</td></tr>
<tr><td>III (n = 692)</td><td>26 (3.8)</td><td>0.82 (0.6-1.2)</td><td rowspan="3"></td></tr>
<tr><td>IV (n = 829)</td><td>67 (8.1)</td><td>1.8 (1.5-2.2)</td></tr>
<tr><td>V (n = 200)</td><td>47 (24)</td><td>6.4 (4.9-8.5)</td></tr>
</table>
<table>
<tr><th>CURB 65 score</th><th>Mortality</th><th>Likelihood ratio (95% CI)</th><th>AUC (95% CI)</th></tr>
<tr><td>0 (n = 1051)</td><td>6 (0.6)</td><td>0.12 (0.05-0.3)</td><td></td></tr>
<tr><td>1 (n = 901)</td><td>27 (3.0)</td><td>0.65 (0.5-0.9)</td><td>0.76 (0.73-0.80)</td></tr>
<tr><td>2 (n = 775)</td><td>47 (6.1)</td><td>1.4 (1.1-1.7)</td><td></td></tr>
</table>
</td>
<td>Funding:
By a grant RO1 HS10049-03 from the Agency for Healthcare Research and Quality, Rockville, Maryland.

Limitations:
for the 2 CURB scores, the item of presence of confusion was not defined by using an Abbreviated Mental Test Score<=8 or new disorientation to person, place or time. Instead the item of altered mental status was used as a</td>
</tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools (including thresholds used)</th><th>Outcomes measures</th><th>Comments</th></tr>
<tr>
<td></td>
<td>Renal disease: 108 (3)
Liver disease: 29 (1)

Pneumonia severity, n (%):
PSI I: 686 (22)
PSI II: 774 (24)
PSI III: 692 (22)
PSI IV: 829 (26)
PSI V: 200 (6)</td>
<td></td>
<td>
<table>
<tr><td>3 (n = 383)</td><td>51 (13)</td><td>3.2 (2.5-4.1)</td><td></td></tr>
<tr><td>4 (n = 64)</td><td>11 (17)</td><td>4.4 (2.3-8.1)</td><td></td></tr>
<tr><td>5 (n = 7)</td><td>3 (43)</td><td>16 (3.6-70)</td><td></td></tr>
</table>
<table>
<tr><th>CURB score</th><th>Mortality</th><th>Likelihood ratio (95% CI)</th><th>AUC (95% CI)</th></tr>
<tr><td>0 (n = 1635)</td><td>28 (1.7)</td><td>0.35 (0.3-0.5)</td><td>0.73 (0.68-0.76)</td></tr>
<tr><td>1 (n = 1035)</td><td>49 (4.7)</td><td>1 (0.8-1.3)</td><td></td></tr>
<tr><td>2 (n = 431)</td><td>53 (12)</td><td>2.9 (2.3-3.7)</td><td></td></tr>
<tr><td>3 (n = 73)</td><td>12 (16)</td><td>4.1 (2.3-7.5)</td><td></td></tr>
<tr><td>4 (n = 7)</td><td>3 (43)</td><td>16 (3.6-70)</td><td></td></tr>
</table>
Data are shown as frequencies (%)

<table>
<tr><td></td><td>Sensitivity</td><td>Specificity</td><td>PPV</td><td>NPV</td></tr>
<tr><td>PSI ≥ IV *</td><td>79% (71-85)</td><td>70% (68-72)</td><td>11% (9-13)</td><td>99% (98-99)</td></tr>
<tr><td>CURB-65 ≥ 2^</td><td>77% (70-84)</td><td>63% (62-65)</td><td>9% (7-11)</td><td>98% (98-99)</td></tr>
<tr><td>CURB ≥ 1^</td><td>81% (73-87)</td><td>53% (51-55)</td><td>8% (6-9)</td><td>98% (98-99)</td></tr>
</table>
*Fine et al defining low CAP (I-III) and high risk (IV-V)
^ Lim et al defining low CAP (0 and 1) or high risk (2-5)
</td>
<td>proxy measure for confusion.

Notes: the study also did a secondary comparison by testing whether a 2-step approach as used in the PSI would improve the predictive performance of the CURB.</td>
</tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools (including thresholds used)</th><th>Outcomes measures</th><th>Comments</th></tr>
<tr>
<td>Author and year: Ananda-Rajah 2008[3]

Study type:
Retrospective study

Selection / patient setting: all eligible patients hospitalized with CAP from a university affiliated hospital for 12 months in Australia (part of the multi-centre PORT study).

Addressing missing data/non reliability of data:

Statistical analysis (including confounders adjusted for): univariate analysis, frequencies, sensitivity, specificity, positive and negative predictive value</td>
<td>Inclusion criteria:
Patients > 18 years old, admission for at least 24 h, principal discharge diagnosis of pneumonia according to ICD-10 AM (Australian), CXR performed within 24 h of admission and haematology and serum biochemistry assessment within 24 h of admission. Medical records were reviewed to confirm the diagnosis of CAP, which was defined as 1 or more symptoms suggestive of CAP (cough, sputum production and fever) plus chest radiograph evidence confirmed by a radiologist.

Exclusion criteria:
Patients with HIV infection, tuberculosis, aspiration pneumonitis or admission to any hospital within the preceding 14 days.

All patients,
N: 1299
Exclusions reasons: normal chest X-ray or because of admission to a hospital within the preceding 14 days.

Included N: 390

Age, mean (SD): 72 (16)
Gender: male, n (%): 229 (56.1%)</td>
<td>• PSI (I to V)
• CURB-65 (0 to 5) (collected upon admission or the first available measurement after the time of presentation to ED)</td>
<td>- 30 day mortality: 63 (15.4%)
- ITU admission: 43 (10.5%)

Results
30-day mortality rates based on PSI and CURB-65 classifications
<table>
<tr><th>PSI score (number of episodes)</th><th>Mortality (number of patients)</th><th>ICU admission (number of patients)</th></tr>
<tr><td>I/II (n = 49)</td><td>1 (2)</td><td>1 (2)</td></tr>
<tr><td>III (n = 65)</td><td>3 (4.6)</td><td>5 (7.7)</td></tr>
<tr><td>IV (n = 181)</td><td>23 (12.7)</td><td>23 (12.7)</td></tr>
<tr><td>V (n = 113)</td><td>36 (31.9)</td><td>14 (12.4)</td></tr>
</table>
<table>
<tr><th>CURB 65 score</th><th>Mortality</th><th>ITU admission (number of patients)</th></tr>
<tr><td>0 (n = 26)</td><td>0</td><td>0</td></tr>
<tr><td>1 (n = 94)</td><td>8 (8.5)</td><td>7 (7.4)</td></tr>
<tr><td>2 (n = 133)</td><td>16 (12)</td><td>10 (7.5)</td></tr>
<tr><td>3 (n = 107)</td><td>20 (18.7)</td><td>20 (18.7)</td></tr>
<tr><td>4 & 5 (n = 48)</td><td>19 (36.6)</td><td>6 (12.5)</td></tr>
</table>
Data are shown as frequencies (%)
<table>
<tr><th></th><th>Sensitivity % (95% CI)</th><th>Specificity % (95% CI)</th><th>PPV % (95% CI)</th><th>NPV % (95% CI)</th></tr>
<tr><td>PSI ≥ IV (Fine et al</td><td>93.7 (84.5-</td><td>31.9 (27-37.1)</td><td>20.1 (15.6-</td><td>96.5 (91.2-</td></tr>
</table>
</td>
<td>Funding:
NA

Limitations: the retrospective design of the study may have resulted in under reporting of such variables such as confusion thus lowering the overall scores of PSI, CURB-65

Notes: the study also did a secondary comparison by excluding patients who didn't have a resuscitation order within</td>
</tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools (including thresholds used)</th><th>Outcomes measures</th><th>Comments</th></tr>
<tr>
<td></td>
<td>Nursing home patients, n (%): 38 (9.3%)

Comorbidities, n (%):
Liver disease: 11 (2.7)
Congestive heart failure: 105 (25.7)
Cerebrovascular disease: 56 (13.7)
Renal disease: 72 (17.6)
Malignancy: 61 (15)
Not for resuscitation order within 24h: 73 (17.9)

Pneumonia severity, n (%):
PSI I/II: 49 (12.6)
PSI III: 65 (16.6)
PSI IV: 181 (46.4)
PSI V: 113 (28.9)

Hospitalization duration, mean days (range): 10.7 (2-91)</td>
<td></td>
<td>
<table>
<tr><td>defining low CAP (I-III) and high risk (IV-V)</td><td>98.2)</td><td></td><td>25.1)</td><td>99.0)</td></tr>
<tr><td>CURB-65 ≥ 3 (Lim et al defining low CAP (0 and 1) or high risk (2-5)</td><td>61.9 (48.8-73.9)</td><td>66.4 (61.1-71.3)</td><td>25.2 (25.1-43)</td><td>90.5 (86.2-93.8)</td></tr>
<tr><td>CURB-65 ≥ 2</td><td>87.3 (76.5-94.4)</td><td>32.5 (27.5-37.7)</td><td>19.1 (14.7-24.1)</td><td>93.3 (87.3-97.1)</td></tr>
</table>
AUC for PSI and CURB-65 was 0.72 and 0.69 respectively.
</td>
<td>24 h of admission.</td>
</tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools (including thresholds used)</th><th>Outcomes measures</th><th>Comments</th></tr>
<tr>
<td>Author and year: Tejera 2007[44]
Study type:
Prospective study

Selection / patient setting: patients who were admitted for pneumonia and presented at the emergency room of the hospital Universitario de Canarias (Spain) were included.

Addressing missing data/non reliability of data:

Statistical analysis (including confounders adjusted for):
frequencies, AUC, results from a multivariate analysis (RR, 95% confidence interval)</td>
<td>Inclusion criteria:
Patients were included after evaluation in the emergency room. CAP was defined as an acute illness associated with 1 or more of the following: new cough with or without sputum production, pleuritic chest pain, dyspnoea, fever or hypothermia, altered breath sounds on auscultation, leucocytosis, plus the presence of a new infiltrate on a chest radiograph evidence in patients who had not been hospitalized within the previous month and in whom no alternative diagnosis has emerged during follow up.

Exclusion criteria:
Patients with HIV infection, tuberculosis, aspiration pneumonitis or admission to any hospital within the preceding 14 days.

All patients,
N: 226
Exclusions reasons: na

Included N: 226

Age > 85 yrs: 39 (17.2%)
Gender: male, n (%): 145 (64.2%)

Comorbidities, n (%):</td>
<td>• PSI (I to V)
• CURB-65 (0 to 5) (collected upon admission to ED)</td>
<td>Mortality (as an end point during admittance): 28 (12.4%)

Results

<table>
<tr><th>PSI score (number of patients)</th><th>Mortality (number of patients)</th><th>AUC</th></tr>
<tr><td>I (n = 22)</td><td>0</td><td rowspan="5">0.752 (0.669-0.836)</td></tr>
<tr><td>II (n = 3)</td><td>0</td></tr>
<tr><td>III (n = 31)</td><td>1</td></tr>
<tr><td>IV (n = 82)</td><td>11%</td></tr>
<tr><td>V (n = 88)</td><td>20.5%</td></tr>
</table>

<table>
<tr><th>CURB-65 score (number of patients)</th><th>Mortality (number of patients)</th><th>AUC</th></tr>
<tr><td>0 (n = 17)</td><td>0</td><td rowspan="6">0.784 (0.669-0.869)</td></tr>
<tr><td>1 (n = 33)</td><td>3%</td></tr>
<tr><td>2I (n = 72)</td><td>4.2%</td></tr>
<tr><td>3 (n = 58)</td><td>13.8%</td></tr>
<tr><td>4 (n = 39)</td><td>35.9%</td></tr>
<tr><td>5 (n = 7)</td><td>28.6%</td></tr>
</table>

Results from a multivariate analysis (including age (85 years or more), dehydration, subjective nutritional score, hand grip (dynamometry), Glasgow coma score, severity of sepsis, PSI, CURB-65, TNFa, IL-6, Strem-1 and IGF-1. Among the variables with predictive independent value</td>
<td>Funding:
NA

Limitations: the outcome of mortality as collected was not time specific

Notes: the aim of the paper was to test the prognostic ability of triggering receptor expressed on myeloid cells-1 (TREM-1) on CAP</td>
</tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools (including thresholds used)	Outcomes measures	Comments
	Dementia: 41 (18.1%) Renal disease: 44 (19.4%) Severe sepsis: 98 (43.3%) **Pneumonia severity, n (%):** PSI I: 22 (9.7%) PSI II: 3 (1.3%) PSI III: 31 (13.7%) PSI IV: 82(36.3%) PSI V: 88 (38.9%)		were IGF-1 less than 37.5 ng/ml (RR 10.2 (3.2-32.5), CURB-65 > 3 (RR 3.3 (1.2-9), TREM-1 > 50 pg/ml (RR 7 (2.3-21), age > 85 years old (RR 6.2 (2.1-18.3), and IL-6 > 80pg/ml (RR 2.9 (1.01-8.2). With these five data, the AUC increases to 0.917 (0.857-0.977).	

Reference	Patient Characteristics	Risk Assessment tools (including thresholds used)	Outcomes measures	Comments
Author and year: Ochoagondar 2011[35] **Study type:** Population based prospective study	**Inclusion criteria:** Pneumonia was defined when a new infiltrate on a chest radiograph was identified with one major criteria (cough, expectoration or fever) or two	• PSI (I to V) • CURB-65 (0 to 5) •CRB-65 (0 to 4) (collected upon admission to ED)	30 days mortality: 80 (13.6%)	**Funding:** Grant from the instituto de Salud Carlos III from the Spanish

Selection / patient setting: community dwelling patients 65 years old and older who had radiographically confirmed CAP (hospitalised or outpatients) from three reference hospitals in the region of Tarragona (Spain) between 2002 and2008. The main sources of data were the hospital discharge databases of the hospitals together with the hospital and primary care clinical records of case patients. These clinical records were used to identify and validate hospitalised and outpatient CAP cases.

Addressing missing data/non reliability of data:

Statistical analysis (including confounders adjusted for): frequencies, AUC, results from a multivariate analysis (RR, 95% confidence interval)

minor criteria (dyspnoea, pleuritic pain, altered mental status, pulmonary consolidation on auscultation and leucocytosis).

Exclusion criteria:
Nosocomial pneumonia, readmissions or other diagnoses.

All patients,
N: 649
Exclusions reasons: 59 did not have available analytical data for PSI and CURB-65.

Included N: 590

Age (mean): 77.4 (SD7.6)
Gender: male, n (%): 63.2%

Comorbidities, n(%):
Chronic pulmonary disease: 225 (38.1%)
Diabetes mellitus: 160 (27.1%)
Chronic heart disease: 152 (25.8%)
Chronic liver disease: 26 (4.4%)
Cerebrovascular disease: 38 (6.4%)
Renal disease: 45 (7.6%)
Cancer: 35 (5.9%)
Smoking: 75 (12.7%)
Corticosteroid therapy: 78 (13.2%)

Pneumonia severity, n (%):
PSI II: 61 (10.3%)
PSI III: 160 (27.1%)
PSI IV: 264 (44.7%)
PSI V: 105 (17.8%)

Results

PSI score (number of patients)	30-day mortality	AUC
I (n = 0)	0	0.73 (0.67-0.79)
II (n = 61)	0	
III (n = 160)	11 (6.9)	
IV (n = 264)	38 (14.4)	
V (n = 105)	31 (29.5)	

CURB 65 score	Mortality	AUC
0 (n = 0)	0	0.67 (0.61-0.74)
1 (n = 293)	22 (7.5)	
2 (n = 220)	32 (14.5)	
3 (n = 60)	16 (26.7)	
4 (n = 15)	8 (53.3)	
5 (n = 2)	2 100)	

CRB 65 score	Mortality	AUC
0 (n = 0)	0	0.72 (0.66-0.78)
1 (n = 411)	27 (6.6)	
2 (n = 138)	36 (26.1)	
3 (n = 37)	15 (40.5)	
4 (n = 4)	2 (50)	

	Sensitivity % (95% CI)	Specificity % (95% CI)	PPV % (95% CI)	NPV % (95% CI)
PSI				
≥ III	100 (94.3-100)	12 (9.34-15.2)	15.1(12.2-18.5)	100(92.6-100)
≥ IV	86.3(76.3-92.6)	41.2(36.9-45.6)	18.7(14.9-23.1)	95(91-97.4)
V	38.7(28.3-50.3)	85.5(82.1-88.4)	29.5(21.2-39.3)	89.9(86.8-92.4)
CURB-65				
≥ 2	72.5(61.2-81.6)	53.1(48.7-57.5)	19.5(15.3-24.6)	92.5(88.7-95.1)

Science and Innovation Ministry

Limitations:

Notes: the authors did also a subgroup analysis for those aged 65-74 and ≥ 75 years old and they found that the discriminatory power (AUC) of the three rules was slightly better in younger (65-74) than older(≥ 75) patients.

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools (including thresholds used)</th><th>Outcomes measures</th><th>Comments</th></tr>
<tr>
<td>Author and year: Alavi-Moghaddam 2013[2]

Study type:
prospective study

Selection / patient setting: patients 65 years old and older who had clinically and radiographically confirmed CAP referred to the emergency department of Imam Hossein Medical Centre (Iran) in 2009.

Addressing missing data/non reliability of data:

Statistical analysis (including confounders adjusted for):
frequencies, sensitivities, specificities, positive and negative predictive values, AUC</td>
<td>Inclusion criteria:
Pneumonia was defined on the grounds of their clinical and paraclinical findings by the emergency and/or infectious disease residents and/ or specialists.

Exclusion criteria:
Patients whose diagnosis changed during the course of treatment.

All patients,
N: 200
Exclusions reasons: not given

Included N: 200

Age in years (mean): 68 (SD 18)
Gender: male, n (%): 122 (60%)

Underlying conditions; the most common underlying condition in the whole population was heart failure. The most common cause of the condition in males under the age of 50 was drug injection abuse and high blood glucose whereas in females of the same age, viral diseases (influenza) and high blood glucose were the prevailing causes.</td>
<td>• PSI (I to V)
• CURB-65 (0 to 5)
(collected upon admission to ED)</td>
<td>30 days mortality: 36 (18%)
ICU admission: 30 (15%)

Results
<table>
<tr><th>PSI score (number of patients)</th><th>30-day mortality</th></tr>
<tr><td>I (n=4)</td><td>0</td></tr>
<tr><td>II (n = 3)</td><td>0</td></tr>
<tr><td>III (n = 13)</td><td>0</td></tr>
<tr><td>IV (n = 103)</td><td>0</td></tr>
<tr><td>V (n = 77)</td><td>36 (46.7%)</td></tr>
</table>
<table>
<tr><th>CURB 65 score</th><th>30-day Mortality</th></tr>
<tr><td>I (n = 4)</td><td>0</td></tr>
<tr><td>II (n = 3)</td><td>0</td></tr>
<tr><td>III (n = 13)</td><td>0</td></tr>
<tr><td>IV (n = 103)</td><td>0</td></tr>
<tr><td>V (n = 77)</td><td>36 (46.7%)</td></tr>
</table>
In predicting mortality
<table>
<tr><th></th><th>Sensitivity % (95% CI)</th><th>Specificity % (95% CI)</th><th>PPV % (95% CI)</th><th>NPV % (95% CI)</th></tr>
<tr><td>PSI
II</td><td>100 (90.4-100)</td><td>2.4 (0.9-6.1)</td><td>18.4(13.6-24.4)</td><td>100(51-100)</td></tr>
</table>
</td>
<td>Funding: NA

Limitations:
The authors mentioned that the number of patients admitted to ICU may have been underestimated as it is possible that certain patients were admitted to other wards due to unavailability of ICU beds (influenced by physician’s decision).

Notes: the authors also reported the results of an analysis of underlying conditions and mortality; they found that heart failure, age, low blood</td>
</tr>
</table>

III	100 (90.4-100)	4.3(2.1-8.5)	18.7(13.8-24.7)	100(64.6-100)	pH and high urea levels, and decreased consciousness level were statistically significant with mortality (p<0.05)
IV	100 (90.4-100)	12.2(8.8-18.1)	20(14.8-26.4)	100(83.4-100)	
V	100 (90.4-100)	75 (67.9-81)	46.8(36-57.8)	100 (98-100)	
CURB-65					
I	100 (90.4-100)	0.6 (0.1-3.4)	18.1(13.4-24)	100(20.6-100)	
II	100 (90.4-100)	5.5 (2.9-10.1)	18.9(13.9-25)	100(70.1-100)	
III	100 (90.4-100)	82.3 (75.8-87.4)	55.4(43.4-66.8)	100(97.2-100)	
IV	75 (58.9-86.3)	97 (93.1-98.7)	84.4(68.3-93.4)	94.6(90.1-100)	
V	11.1(4.4-25.3)	99.4 (96.6-99.9)	80(37.6-96.4)	83.6(77.8-88.1)	

In predicting ICU admission

	Sensitivity % (95% CI)	Specificity % (95% CI)	PPV % (95% CI)	NPV % (95% CI)
PSI				
II	100 (92.9-100)	2.7 (1.0-6.7)	25.5(19.9-32)	100(51-100)
III	100 (92.9-100)	4.7(2.3-9.3)	25.9(20.2-32.5)	100(64.6-100)
IV	100 (92.9-100)	13.3(8.8-19.7)	27.8(21.8-34.7)	100(83.9-100)
V	90 (78.6-95.7)	78.7 (71.4-84.5)	58.4(47.3-68.8)	95.9(90.8-98.3)
CURB-				

65 I II III IV V	 100 (88.7-100) 100 (88.7-100) 96.7 (83.3-99.4) 30 (16.7-47.9) 16.7(7.3-33.6)	 0.7 (0.1-3.7) 6 (3.2-11) 89.3 (83.4-93.3) 98 (94.3-99.3) 100 (97.5-99.9)	 16.8(12-22.9) 17.5(12.6-23.9) 64.4(49.8-76.8) 75(46.8-91.1) 100(56.6-100)	 100(20.7-100) 100(70.1-100) 99.3(95.3-99.9) 87.5(81.7-91.7) 85.7(79.8-80.1)

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools (including thresholds used)</th><th>Outcomes measures</th><th>Comments</th></tr>
<tr>
<td>Author and year: Lee 2013[30]

Study type:
Retrospective study

Selection / patient setting: retrospective analysis of a prospective registry database of all consecutive patients with CAP who visited the emergency department and hospitalised in a tertiary academic hospital (950-bed).

Addressing missing data/non reliability of data:

Statistical analysis (including confounders adjusted for):
frequencies, AUC, results from a multivariate analysis (RR, 95% confidence interval)</td>
<td>Inclusion criteria:
Hospitalised patients older than 18 years old with CAP which was defined as evidence of a pulmonary infiltrate on chest radiograph and symptoms consistent with pneumonia, including cough, dyspnoea, fever and/ or pleuritic chest pain which were not acquired in a hospital or nursing home. If a pulmonary infiltrate was absent on the initial chest radiograph, abnormal lung sounds on the initial physical examination and pulmonary infiltrate on a follow-up chest radiograph were accepted as equivalent.

Exclusion criteria:
Patients younger than 18 years, had been transferred from another hospital, was discharged form a hospital within the past 10 days, experienced an episode of pneumonia within the past 30 days, exhibits active pulmonary tuberculosis, has known HIV positivity, or is chronically immunosuppressed.

All patients,
N: 744</td>
<td>• PSI (I to V)
• CURB-65 (0 to 5)
(collected upon admission to ED)</td>
<td>30 days mortality: 100 (13.4%)

Results
<table>
<tr><th>PSI score (number of patients)</th><th>30-day mortality</th><th>AUC (95% CI)</th></tr>
<tr><td>I/II (n = 132)</td><td>2 (1.5%)</td><td rowspan="4">0.74 (0.70-0.79)</td></tr>
<tr><td>III (n = 136)</td><td>4 (2.9%)</td></tr>
<tr><td>IV (n = 300)</td><td>41 (13.7%)</td></tr>
<tr><td>V (n = 176)</td><td>53 (30.1%)</td></tr>
</table>
<table>
<tr><th>CURB 65 score</th><th>30-day Mortality</th><th>AUC (95% CI)</th></tr>
<tr><td>0 (n = 96)</td><td>2 (2.1%)</td><td rowspan="6">0.74 (0.69-0.79)</td></tr>
<tr><td>1 (n = 214)</td><td>11 (5.1%)</td></tr>
<tr><td>2 (n = 253)</td><td>36 (14.2%)</td></tr>
<tr><td>3 (n = 133)</td><td>27 (20.3%)</td></tr>
<tr><td>4 (n = 38)</td><td>16 (42.1%)</td></tr>
<tr><td>5 (n = 10)</td><td>28 (80%)</td></tr>
</table>
Results of multivariate logistic analysis* in predicting 30-day mortality
<table>
<tr><th></th><th>Odds ratio (95% CI)</th><th>P value</th></tr>
<tr><td>PSI
I/ II
III</td><td>
Reference
1.47 (0.24-8.93)</td><td>

0.648</td></tr>
</table></td>
<td>Funding: partially supported by grant number 02-2010-025 from SNUBH research fund.

Limitations: the aim of the paper to evaluate the association of red cell distribution width with mortality in patients with CAP.

Notes: the authors also reported the results ICU admission and vasopressor use by quartile of red cell distribution</td>
</tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools (including thresholds used)</th><th>Outcomes measures</th><th>Comments</th></tr>
<tr><td></td><td>Exclusions reasons: medical records were not available for 10 patients and patients were identified as having been transferred to other facilities.
Included N: 721
Age in years (mean): 70.1 (SD 15)
Gender: male, n (%): 32%
Comorbidities, n (%);
Hearth failure: 18 (2.4%)
Renal failure: 83 (11.2%)
Liver disease 44 (5.9%)
COPD: 158 (9.9%)
Neoplasm: 195 (26.2%)
Neurologic condition: 187 (25.1%)
Diabetes mellitus: 222 (29.8%)
PSI class:
I, II: 132 (17.7%)
III: 136 (18.3%)
IV: 300 (40.3%)
V: 176 (23.7%)
CURB-65:
0: 96 (12.9%)
1: 214 (28.8%)
2: 253 (34%)
3: 133 (17.9%)
4: 38 (5.1%)
5: 10 (1.3%)</td><td></td><td><table>
<tr><td>IV</td><td>4.76 (1.01-22.53)</td><td>0.049</td></tr>
<tr><td>V</td><td>7.10 (1.42-35.42)</td><td>0.017</td></tr>
<tr><td>CURB-65</td><td></td><td></td></tr>
<tr><td>0</td><td>Reference</td><td></td></tr>
<tr><td>1</td><td>1.34 (0.25-7.20)</td><td>0.730</td></tr>
<tr><td>2</td><td>2.26 (0.45-11.30)</td><td>0.323</td></tr>
<tr><td>3</td><td>2.44 (0.46-12.82)</td><td>0.292</td></tr>
<tr><td>4</td><td>3.42 (0.58-20.06)</td><td>0.174</td></tr>
<tr><td>5</td><td>37.02 (2.49-550.32)</td><td>0.009</td></tr>
</table>
* other variables in the analysis: quartile of red cell distribution width, haematocrit, mean corpuscular haemoglobin, albumin, cholesterol, prothrombin time</td><td>width but not by assessment tool.</td></tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools (including thresholds used)</th><th>Outcomes measures</th><th>Comments</th></tr>
<tr>
<td>Author and year: Man 2007[33]

Study type:
Prospective study

Selection / patient setting: consecutive patients admitted to hospital (the main teaching hospital of the Faculty of Medicine of the Chinese University of Hong Kong) through the emergency department with a provisional diagnosis of CAP between 1st January and 31st December 2004.

Addressing missing data/non reliability of data:

Statistical analysis (including confounders adjusted for):
frequencies, AUC, results from a multivariate analysis (RR, 95% confidence interval)</td>
<td>Inclusion criteria:
All patients older than 17 years old admitted to hospital with CAP which was defined as acute infection of the pulmonary parenchyma accompanied by the presence of an acute pulmonary infiltrate on chest radiograph in a patient not hospitalised for more than 14 days before onset of symptoms. The final diagnosis was made by a respiratory physician and was based on the clinical, radiological and laboratory results.

Exclusion criteria:
Patients with severe immunosuppression (HIV infection, neutropenia < 1x 10^9/l , on long term immunosuppressants or steroids, or solid organ transplant recipients), patients with a final diagnosis of tuberculosis, patients who had been in hospital within the previous 14 days and those with a diagnosis other than CAP after admission.
All patients,
N: 1648
Exclusions reasons: 632 (38%) were excluded did not meet inclusion criteria.</td>
<td>• PSI (I to V)
• CURB-65 (0 to 5)
• CRB-65 (0-4)
(collected upon admission to ED)</td>
<td>30 days mortality: 87 (8.6%)
ICU admission: 41 (4.0%)

Results
<table>
<tr><th>PSI score (number of patients)</th><th>30-day mortality (AUC: 0.736 (0.687-0.786)</th><th>ICU admission</th></tr>
<tr><td>Low (II/III)(n = 480)</td><td>14 (2.9%)</td><td>13 (2.7%)</td></tr>
<tr><td>Intermediate (IV) (n = 355)</td><td>33 (9.3%)</td><td>16 (4.5%)</td></tr>
<tr><td>High (V) (n = 181)</td><td>40 (22.1%)</td><td>12 (6.6%)</td></tr>
</table>
<table>
<tr><th>CURB 65 score</th><th>30-day Mortality (AUC: 0.733 (0.689-0.787)</th><th>ICU admission</th></tr>
<tr><td>Low (0-1) (n = 440)</td><td>13 (3%)</td><td>10 (2.3%)</td></tr>
<tr><td>Intermediate (2) (n = 315)</td><td>23 (7%)</td><td>14 (4.4%)</td></tr>
<tr><td>High (3-5) (n = 261)</td><td>51 (19.5%)</td><td>17 (6.5%)</td></tr>
</table>
<table>
<tr><th>CRB 65 score</th><th>30-day Mortality (AUC: 0.694 (0.634-0.753)</th><th>ICU admission</th></tr>
<tr><td>Low (0) (n = 128)</td><td>3 (2.3%)</td><td>5 (3.9%)</td></tr>
<tr><td>Intermediate (1-</td><td>58 (7.4%)</td><td>26 (3.3%)</td></tr>
</table>
</td>
<td>Funding: na

Limitations: the definition of confusion in the CURB-65 was not based on Abbreviated Mental Test Score of ≤ 8 but on Glasgow Coma Scale of ≤ 14 (as too many dialects are used in Hong Kong)

Notes: the authors also reported that there was a statistically significant trend of increasing mortality with worsening</td>
</tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools (including thresholds used)</th><th>Outcomes measures</th><th>Comments</th></tr>
<tr>
<td></td>
<td>Included N:1016
Age in years (mean): 72 (SD 17)
Gender: male, n (%): 583 (57.4%)
Nursing home residents: 243 (24.3%)
Comorbidities (> 5%), n (%);
Congestive health failure: 124 (12.2%)
Renal failure: 84 (8.3%)
COPD: 167 (16.4%)
Cerebrovascular disease: 176 (17.3%)
Old pulmonary tuberculosis: 85 (8.4%)
PSI class:
I: 0
II: 242 (23.8%)
III: 238 (23.4%)
IV: 355 (34.9%)
V: 181 (17.8%)
CURB-65:
0: 107 (10.5%)
1: 333 (32.8%)
2: 315 (31%)
3: 189 (18.6%)
4: 64 (6.3%)
5: 8 (0.8%)
CRB-65:
0: 128 (12.6%)
1: 489 (48.1%)
2: 294 (28.9%)
3: 95 (9.4%)
4: 10 (1%)</td>
<td></td>
<td>
<table>
<tr><td>2) (n = 783)</td><td></td><td></td></tr>
<tr><td>High (3-4) (n = 105)</td><td>26 (24.8%)</td><td>10 (9.5%)</td></tr>
</table>
In predicting 30-day mortality
<table>
<tr><th></th><th>Sensitivity %</th><th>Specificity %</th><th>PPV %</th><th>NPV %</th></tr>
<tr><td>PSI</td><td></td><td></td><td></td><td></td></tr>
<tr><td>≥ II</td><td>100</td><td>0</td><td>8.6</td><td>Na</td></tr>
<tr><td>≥ III</td><td>97.7</td><td>25.8</td><td>11</td><td>99.2</td></tr>
<tr><td>≥ IV*</td><td>83.9</td><td>50.2</td><td>13.6</td><td>97.1</td></tr>
<tr><td>≥ V</td><td>46</td><td>84.8</td><td>22.1</td><td>94.4</td></tr>
<tr><td>CURB-65</td><td></td><td></td><td></td><td></td></tr>
<tr><td>≥ 0</td><td>100</td><td>0</td><td>8.6</td><td>Na</td></tr>
<tr><td>≥ 1≥ 2*</td><td>98.9</td><td>11.4</td><td>9.5</td><td>99.1</td></tr>
<tr><td>≥ 3</td><td>85.1</td><td>46</td><td>12.8</td><td>97</td></tr>
<tr><td>≥ 4</td><td>58.6</td><td>77.4</td><td>19.5</td><td>95.2</td></tr>
<tr><td>≥ 5</td><td>23</td><td>94.4</td><td>27.8</td><td>92.9</td></tr>
<tr><td></td><td>3.4</td><td>99.5</td><td>37.5</td><td>91.7</td></tr>
<tr><td>CRB-65</td><td></td><td></td><td></td><td></td></tr>
<tr><td>≥ 0</td><td>100</td><td>0</td><td>8.6</td><td>Na</td></tr>
<tr><td>≥ 1*</td><td>96.6</td><td>13.5</td><td>9.5</td><td>97.7</td></tr>
<tr><td>≥ 2</td><td>67.8</td><td>63.4</td><td>14.8</td><td>95.5</td></tr>
<tr><td>≥ 3</td><td>29.9</td><td>91.5</td><td>24.8</td><td>93.3</td></tr>
<tr><td>≥ 4</td><td>4.6</td><td>99.4</td><td>40</td><td>91.7</td></tr>
</table>
*thresholds to define low risk groups
</td>
<td>risk groups in all risk severity tools (p<0.001). ICU admission rates also increased with the risk levels of each rule but were only statistically significant in CURB-65 and CRB-65.</td>
</tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools (including thresholds used)</th><th>Outcomes measures</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Abisheganaden 2012[1]

Study type:
Retrospective study using secondary analyses of medical records and administrative data.

Selection / patient setting: first hospital episodes of adults aged 55 years or older with the principal diagnosis of CAP in the 12 months of 2007 in three acute-care public hospitals in Singapore.

Addressing missing data/non reliability of data:

Statistical analysis (including confounders adjusted for):
frequencies, AUC, results from a univariate analysis (ORs, 95% confidence interval)</td>
<td>Inclusion criteria:
CAP diagnosed by presence of acute symptoms or signs of pneumonia accompanied by the presence of an acute pulmonary infiltrate on CXR less than 24 h before and less than 48 h after hospital admission.
Exclusion criteria:
Patients who were residents in long term facilities, undergoing chemotherapy, haemodialysis and intravenous antibiotics or wound care in the prior 30 days, HIV infection, neutropenia < 1x 10^9/l , on long term and patients who had been in hospital within the previous 14 days and those with unavailable medical records.
All patients,
N: 3180
Exclusions reasons: 2019 were excluded as they did not meet inclusion criteria, 19 had second and subsequent hospital episodes
Included N:1052
Age in years (mean): 76.7 (SD 10.6)
Gender: male, n (%): 489 (56.1%)
Comorbidities (> 5%), n (%);
Stroke: 220 (20.9%)</td>
<td>• PSI (I to V)

• CURB-65 (0 to 5)
• Enhanced CURB (plus age, metastatic cancer, solid tumour without metastasis, stroke)
(collected upon admission to ED)</td>
<td>30 days mortality: 181 (17.2%)
Results
<table>
<tr><th>PSI score</th><th>30-day mortality</th></tr>
<tr><td>III (n = 162)</td><td>3 (1.9%)</td></tr>
<tr><td>III (n = 342)</td><td>20 (5.9%)</td></tr>
<tr><td>IV (n = 394)</td><td>87 (22.1%)</td></tr>
<tr><td>V (n = 154)</td><td>71 (46.1%)</td></tr>
</table>
<table>
<tr><th>CURB 65 score</th><th>30-day Mortality</th></tr>
<tr><td>O (n = 115)</td><td>5 (4.4%)</td></tr>
<tr><td>1 (n = 439)</td><td>40 (9.1%)</td></tr>
<tr><td>2 (n = 390)</td><td>90 (23.1%)</td></tr>
<tr><td>3 (n = 98)</td><td>39 (39.8%)</td></tr>
<tr><td>4/5 (n = 10)</td><td>7 (70%)</td></tr>
</table>
<table>
<tr><th>Score:
Predictive variable</th><th>OR (95% CI)</th><th>AUC
(95% CI)</th></tr>
<tr><td>PSI (II as a reference)
III
IV
V</td><td>
3.29 (0.96 to 11.24)
15.02(4.68 to 48.24)
45.34 (13.86 to 148.33)</td><td>0.77 (0.73 to 0.79)</td></tr>
<tr><td>CURB-65 (0 as a reference)
1
2
3
4 & 5</td><td>
2.21 (0.85 to 5.72)
6.60 (2.61 to 16.67)
14.54 (5.44 to 38.87)
51.33 (10.13 to 260.04)</td><td>0.70 (0.66 to 0.74)</td></tr>
<tr><td>Enhanced CURB (0 as a reference)</td><td></td><td>0.80 (0.77 to 0.83)</td></tr>
</table></td>
<td>Funding:
National Medical Research Council.

Limitations:
The study did not account for do-not-resuscitate (DNR) status due to inconsistent DNR documentation in routine charts at the hospitals (which is probably an additional risk factor for short term mortality)

Notes: the authors developed an enhanced CURB score using a statistical</td>
</tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools (including thresholds used)	Outcomes measures			Comments
	Dementia: 125 (11.9%) Solid tumour without metastasis: 111 (10.6%) Renal failure: 113 (10.7%) Depression: 62 (5.9%) Chronic pulmonary disease: 187 (17.8%) Arrhythmias: 177 (16.8%) Neurological disorders: 117 (11.1%) Diabetes mellitus: 343 (32.6%) **PSI class:** I: 0 II: 162 (15.4%) III: 342 (32.5%) IV: 394 (37.5%) V: 154 (14.6%) **CURB-65:** 0: 115 (10.9%) 1: 439 (41.7%) 2: 390 (37.1%) 3: 98 (9.3%) 4: 10 (1%) 5: 0 **CRB-65:** 0: 128 (12.6%) 1: 489 (48.1%) 2: 294 (28.9%) 3: 95 (9.4%) 4: 10 (1%)		***1***	2.81 (1.82 to 4.32)		development and validation process. They suggested that external validation of the enhanced CURB score to other populations would be the next step.
			2	4.53 (2.57 to 7.99)		
			3 or 4	21.6 (5.14 to 90.82)		
			Age (per year)	1.06 (1.04 to 1.08)		
			Metastatic cancer	25.96 (8.13 to 82.95)		
			Solid tumour without metastasis	1.91 (1.14 to 3.19)		
			Stroke	1.96 (1.32 to 2.90)		

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools (including thresholds used)</th><th>Outcomes measures</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Capelastegui et al. 2006[13]
Study type:
Retrospective analysis of a prospective, consecutive cohort study
Selection / patient setting:
Galdakao teaching hospital, Basque Country, Spain
Consecutive cohort of adults admitted to the ED of the Galdakao hospital with a diagnosis of CAP over a 4 year period.
Addressing missing data/non reliability of data: all missing data or unperformed laboratory tests were considered to be normal.
Statistical analysis (including confounders adjusted for):
Frequencies, ROC analysis</td>
<td>Diagnosis:
Pneumonia defined as CXR pulmonary infiltrates and clinical symptoms consistent with pneumonia (cough, dyspnoea, fever, and/or pleuritic chest pain)
Inclusion criteria:
Adults (≥ 18 years) with a diagnosis of CAP
Exclusion criteria:
• HIV-positive
• Chronically immunosuppressed
• Hospitalised in the previous 14 days
All patients, N: 1776
Exclusions reasons: 2.9% had incomplete information on scores
Included N: 1776 (as there was imputation of missing values)
Age, mean (SD): 61.8 (20.5)
Age ≥ 65 years, n (%): 973 (54.8)
Gender: male, n (%): 1124 (6.33)
Nursing home patients, n (%): 102 (5.7)
Comorbidities, n (%):
Neoplastic disease: 72 (4.1)
Liver disease: 62 (3.5)
Congestive heart failure: 101 (5.7)
Cerebrovascular disease: 144 (8.1)
Renal disease: 115 (6.5)
Pneumonia severity, n (%):
PSI I: 520 (29.3)
PSI II: 287 (16.2)
PSI III: 338 (19)
PSI IV: 438 (24.7)
PSI V: 193 (10.9)
LOS, mean (SD): 5.1 (4.3)</td>
<td>• PSI (I to V)
• CURB-65 (0 to 5)
• CRB-65 (0 to 4)</td>
<td>
• 30-day mortality: 119 (6.7%)
• Mechanical ventilation: 18 (1%)
Results
AUC (95% CI) predicting 30-day mortality:
• PSI: 0.888 (0.864-0.912)
• CURB-65: 0.870 (0.844-0.895)
• CRB-65: 0.864 (0.835-0.892)
<table>
<tr><th>CURB-65 score</th><th>30-day mortality</th><th>Mechanical ventilation</th></tr>
<tr><td>0 (n = 699)</td><td>0</td><td>0</td></tr>
<tr><td>1 (n = 377)</td><td>4 (1.1%)</td><td>2 (0.5%)</td></tr>
<tr><td>2 (n = 474)</td><td>36 (7.6%)</td><td>9 (1.9%)</td></tr>
<tr><td>3 (n = 224)</td><td>47 (21%)</td><td>4 (2%)</td></tr>
<tr><td>4 (n = 62)</td><td>26 (41.9%)</td><td>2 (4.2%)</td></tr>
<tr><td>5 (n = 10)</td><td>6 (60%)</td><td>1 (11.1%)</td></tr>
</table>
<table>
<tr><th>CRB 65 score</th><th>30-day Mortality</th><th>Mechanical ventilation</th></tr>
<tr><td>0 (n = 716)</td><td>0</td><td>1 (0.1)</td></tr>
<tr><td>1 (n = 686)</td><td>28 (4.1%)</td><td>8 (1.2%)</td></tr>
<tr><td>2 (n = 294)</td><td>55 (18.7%)</td><td>6 (2.2%)</td></tr>
<tr><td>3 (n = 69)</td><td>30 (43.5%)</td><td>2 (3.9%)</td></tr>
<tr><td>4 (n = 11)</td><td>6 (54.6%)</td><td>1 (10%)</td></tr>
</table>
<table>
<tr><th>PSI score</th><th>30-day mortality</th></tr>
<tr><td>Low (I/II/III)(n = 1145)</td><td>0.7%</td></tr>
<tr><td>High (IV/V) (n = 631)</td><td>17.6%</td></tr>
</table>
<table>
<tr><th>CURB-65 score</th><th>30-day mortality</th></tr>
<tr><td>0-1 (n = 1006)</td><td>0.4%</td></tr>
<tr><td>2 (n = 474)</td><td>7.6%</td></tr>
<tr><td>> 2 (n = 296)</td><td>26.7%</td></tr>
</table>
</td>
<td>Funding:
NR

Limitations:
CURB-65 was not assessed as a tool for admission criteria

Additional outcomes:

Notes: the authors stated that the strength of the study was that it included bot inpatients and outpatients therefore it was possible to assess the utility of the CURB-65 in assisting the decision for hospital admission.</td>
</tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools (including thresholds used)</th><th>Outcomes measures</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Menendez 2009[34]
Study type:
Prospective longitudinal study

Selection / patient setting: Patients with CAP consecutively hospitalised in two hospitals in Spain

Addressing missing data/non reliability of data:

Statistical analysis (including confounders adjusted for):
ROC analysis</td>
<td>Diagnosis:
CAP was defined as new radiographic infiltrate and at least two compatible clinical symptoms consistent with pneumonia.

Inclusion criteria:
No further details were given.

Exclusion criteria:
• Admission to hospital within the previous 15 days
• Immunosuppressive and/or glucocorticosteroid treatment,
• leucopaenia < 1000/mm^3
• neutropaenia < 500/mm^3
• patients with do-not-resuscitate (DNR) orders.
All patients, N: 480
Exclusions reasons: not given
Included N: 453
Age, mean (SD): 67.3 (17.1)
Gender: male, n (%): 282 (58.7%)
Long term care facility patients, n (%): 24 (5.3%)
Comorbidities, n (%):
Heart failure: 76 (16.8)
Renal failure: 25 (5.5)
Diabetes: 91 (20.1)
Liver disease: 12 (2.6)
COPD: 79 (17.4)</td>
<td>• PSI (I to V)
• CURB-65 (0 to 5)
• CRB-65 (0 to 4)</td>
<td>• 30-day mortality: 36 (7.9%)
Results
AUC (95% CI) predicting 30-day mortality:
• PSI: 0.81 (0.75-0.87)
• CURB-65: 0.82 (0.76-0.89)
• CRB-65: 0.79 (0.72-0.87)

<table>
<tr><th>PSI score</th><th>30-day Mortality</th></tr>
<tr><td>I (n = 48)</td><td>0</td></tr>
<tr><td>II (n = 73)</td><td>0</td></tr>
<tr><td>III (n = 95)</td><td>2 (2.1%)</td></tr>
<tr><td>IV (n = 167)</td><td>14 (8.3%)</td></tr>
<tr><td>V (n = 70)</td><td>20 (28.6%)</td></tr>
</table>

<table>
<tr><th>CURB 65 score</th><th>30-day Mortality</th></tr>
<tr><td>0 (n = 64)</td><td>1 (1.5%)</td></tr>
<tr><td>1 (n = 141)</td><td>1 (0.1%)</td></tr>
<tr><td>2 (n = 130)</td><td>7 (5.4%)</td></tr>
<tr><td>3 (n = 79)</td><td>13 (16.5%)</td></tr>
<tr><td>4 (n = 33)</td><td>10(30.3%)</td></tr>
<tr><td>5 (n = 6)</td><td>4 (66.7%)</td></tr>
</table>

<table>
<tr><th>CRB 65 score</th><th>30-day Mortality</th></tr>
<tr><td>0 (n = 79)</td><td>1 (1.2%)</td></tr>
<tr><td>1 (n = 193)</td><td>4 (2.1%)</td></tr>
<tr><td>2 (n = 126)</td><td>14 (11.1%)</td></tr>
</table>
</td>
<td>Funding:
BY CIBERES grant, TV3 TV040530 (grant for research not related to any industry)

Limitations:
outpatients with CAP were not included in the study

Additional outcomes:

Notes: the study was designed to test the diagnostic value of IL6, IL8, IL10, tumour necrosis factor α and the markers CRP and CPT.</td>
</tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools (including thresholds used)	Outcomes measures		Comments
	Neurological disease: 98 (21.6) Neoplasm: 19 (4.1)		3 (n = 42) 4 (n = 7)	13 (31%) 4 (57.1%)	

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Fukuyama et al. 2011[23]
Study type:
Prospective
Selection / patient setting:
Community hospital in Kurashiki City, Japan.
Adults admitted to hospital with CAP diagnosis
Addressing missing data/non reliability of data:.205 (40.6%) patients excluded from evaluation as no arterial blood gas data available
Statistical analysis (including confounders adjusted for):
ROC analysis</td>
<td>Diagnosis:
CAP diagnosis based on clinical signs and symptoms of LRTI (fever, cough, purulent sputum) in addition to new CXR infiltrate
Inclusion criteria:
Patients with CAP diagnosis
Exclusion criteria:
• HAP, HCAP or VAP
• Patients who develop comorbid conditions during follow-up
All patients, N: 505
Exclusions reasons: NR
Included N: 505
Age, median (range): 76 (67-83)
Gender: male, n (%): 339 (67.13)
Nursing home patients, n (%): excluded (HCAP)
Comorbidities, n (%):
Chronic pulmonary disease: 200 (39.6)
Chronic heart disease: 126 (25.0)
Cerebrovascular disease: 120 (23.8)
Diabetes: 100 (19.8)
Cancer: 47 (9.3)
Pneumonia severity: NR
LOS, median (range): 10 (7-18)</td>
<td>• SCAP (Espana rule)
• PSI
• A-DROP
• CURB-65
• IDSA/ ATS
• SMART-COP</td>
<td>•In-hospital mortality
•ICU admission</td>
<td>e) In-hospital mortality , n (%); 33 (6.5)
f) ICU admission, n (%): 32 (6.3)
g) Predictive value of severity tools for in-hospital mortality
<table>
<tr><th>Severity tool</th><th>Sensitivity %</th><th>Specificity %</th><th>PPV %</th><th>NPV %</th></tr>
<tr><td>SCAP</td><td>96.7</td><td>35.4</td><td>14.4</td><td>99.0</td></tr>
<tr><td>PSI IV-V</td><td>93.3</td><td>31.3</td><td>13.2</td><td>97.7</td></tr>
<tr><td>A-DROP (3-5)</td><td>76.7</td><td>59.7</td><td>17.6</td><td>95.8</td></tr>
<tr><td>CURB-65 (3-5)</td><td>60.0</td><td>68.7</td><td>17.6</td><td>93.9</td></tr>
<tr><td>IDSA/ATS</td><td>86.7</td><td>61.9</td><td>20.3</td><td>97.6</td></tr>
<tr><td>SMART-COP</td><td>93.3</td><td>45.1</td><td>16.0</td><td>98.4</td></tr>
</table>
h) Predictive value of severity tools for ICU admission
<table>
<tr><th>Severity tool</th><th>Sensitivity %</th><th>Specificity %</th><th>PPV %</th><th>NPV %</th></tr>
<tr><td>SCAP</td><td>93.5</td><td>35.2</td><td>14.4</td><td>97.9</td></tr>
<tr><td>PSI IV-V</td><td>93.5</td><td>31.5</td><td>13.7</td><td>97.7</td></tr>
<tr><td>A-DROP (3-5)</td><td>71.0</td><td>59.2</td><td>16.8</td><td>94.6</td></tr>
<tr><td>CURB-65 (3-5)</td><td>77.4</td><td>70.8</td><td>23.5</td><td>96.4</td></tr>
<tr><td>IDSA/ATS</td><td>93.5</td><td>62.9</td><td>22.7</td><td>98.8</td></tr>
<tr><td>SMART-COP</td><td>100</td><td>46.1</td><td>17.7</td><td>100</td></tr>
</table>
</td>
<td>Funding:
National health and medical research council of Australia

Limitations
• As only patients from one centre were included, the sample might not reflect the full patient population
• HCAP was excluded as recent evidence indicates HCAP differs from CAP regarding pathogens and prognosis
• The performance of severity scores was evaluated only in patients with full data. Low severity cases might have been excluded as patients without arterial blood gases information were excluded (arterial blood gases are usually not performed in patients without respiratory failure)

Additional outcomes:
Readmission within 30 days
Recurrence
Notes:</td>
</tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Barlow et al. 2007[6]
Study type:
Retrospective

Selection / patient setting:
Two hospitals: a teaching hospital and a district general hospital in England, UK. Adults admitted to hospital with a diagnosis of CAP

Addressing missing data/non reliability of</td>
<td>Diagnosis:
CAP diagnosis by a specialist register or consultant doctor or had a new infiltrate on CXR

Inclusion criteria:
Patients were included if they were receiving antibiotics for a suspected LRTI and had either a new infiltrate on CXR or a clinical diagnosis by a specialist

Exclusion criteria:
Non-pneumonia diagnosis
Aspiration, hypostatic pneumonia or HAP
Initial diagnosis of CAP was changed before discharge from hospital
HIV-positive, neutropenia</td>
<td>• CURB-65
• CRB-65
• SIRS
• SEWS</td>
<td>30 day mortality</td>
<td>a) 30-day mortality , n (%); 13 (3)
b) ICU admission, n (%): 79 (19)
c) Predictive value of severity tools for 30-day mortality in CXR-confirmed cohort (218 patients)
<table>
<tr><th>Severity</th><th>Mortality</th><th>Sensitivity</th><th>Specificity</th><th>PPV</th><th>NPV</th></tr>
<tr><td colspan="6">CURB-65</td></tr>
<tr><td>CURB-65 = 0</td><td>0/37 (0%)</td><td>100%</td><td>0%</td><td>14%</td><td>NC</td></tr>
<tr><td>CURB-65 = 1</td><td>1/48 (2%)</td><td>100%</td><td>20%</td><td>17%</td><td>100%</td></tr>
<tr><td>CURB-65 = 2</td><td>8/54 (15%)</td><td>97%</td><td>45%</td><td>22%</td><td>99%</td></tr>
<tr><td>CURB-65 = 3</td><td>10/51 (20%)</td><td>70%</td><td>69%</td><td>27%</td><td>93.5%</td></tr>
<tr><td>CURB-65 = 4</td><td>9/24 (37.5%)</td><td>23%</td><td>91%</td><td>29%</td><td>88%</td></tr>
<tr><td>CURB-65 = 5</td><td>2/4 (50%)</td><td>7%</td><td>99%</td><td>50%</td><td>87%</td></tr>
<tr><td colspan="6">CRB-65</td></tr>
<tr><td>CRB-65 = 0</td><td>0/47 (0%)</td><td>100%</td><td>0%</td><td>14%</td><td>NC</td></tr>
<tr><td>CRB-65 = 1</td><td>8/75 (11%)</td><td>100%</td><td>25%</td><td>17.5%</td><td>100%</td></tr>
<tr><td>CRB-65 = 2</td><td>10/62 (16%)</td><td>73%</td><td>61%</td><td>23%</td><td>93%</td></tr>
<tr><td>CRB-65 = 3</td><td>10/30 (33%)</td><td>40%</td><td>88%</td><td>35%</td><td>90%</td></tr>
<tr><td>CRB-65 = 4</td><td>2/4 (50%)</td><td>7%</td><td>99%</td><td>50%</td><td>87%</td></tr>
<tr><td colspan="6">SIRS used in four different ways</td></tr>
<tr><td>No SIRS[1]</td><td>10/62 (16%)</td><td>100%</td><td>0%</td><td>14%</td><td>NC</td></tr>
<tr><td>SIRS</td><td>5/110 (4.5%)</td><td>67%</td><td>28%</td><td>13%</td><td>84%</td></tr>
<tr><td>Severe sepsis/septic shock</td><td>15/46 (33%)</td><td>50%</td><td>83.5%</td><td>33%</td><td>91%</td></tr>
<tr><td>SIRS = 0[2]</td><td>4/18 (22%)</td><td>100%</td><td>0%</td><td>14%</td><td>NC</td></tr>
</table>
</td>
<td>Funding:
The original study was funded by NHS Education Scotland

Limitations
• Patients were included using a pragmatic, real-life definition of CAP. However, subgroup analysis of CXR cohort confirmed the findings.
• As urine output cannot be measured accurately on admission to hospital and</td>
</tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results						Comments
data: 419 (83%) patients had full data for all the tools. **Statistical analysis (including confounders adjusted for):** ROC analysis	secondary to chronic illness or treatment or markedly immunosuppressed Progressive malignancy Chronic respiratory disease other than asthma or COPD Age < 16 years **All patients,** N: 503 Exclusions reasons: NR **Included** N: 503 (218 patients with CXR-confirmed pneumonia) **Age, median (range):** 74 (16-98) **Age > 65 years, n (%):** 292 (70%) **Gender: male, n (%):**			SIRS = 1	6/44 (14%)	87%	7%	13%	78%	would delay the assessment of severity, oliguria was also excluded as a criterion of hypoperfusion and was not scored in SEWS **Additional outcomes**: Analysis in the main cohort without confirmed CXR diagnosis **Notes:** Of the 503 included patients, 218 patients had CXR-confirmed
				SIRS = 2	9/67 (13%)	67%	28%	13%	84%	
				SIRS = 3	10/60 (17%)	37%	58.5%	12%	85%	
				SIRS = 4	1/29 (3%)	3%	85%	3%	85%	
				SIRS = 0[3]	4/18 (22%)	100%	0%	14%	NC	
				SIRS = 1	6/44 (14%)	87%	7%	13%	78%	
				SIRS = 2	2/47 (4%)	67%	28%	13%	84%	
				SIRS = 3	3/41 (7%)	60%	52%	16.5%	89%	
				SIRS = 4	0/22 (0%)	50%	72%	22%	90%	
				Severe sepsis/septic shock	15/46 (33%)	50%	83.5%	33%	91%	
				No SIRS or hypotension/ organ hypoperfusion	4/43 (9%)	100%	0%	14%	NC	
				SIRS	5/110 (4.5%)	87%	21%	15%	91%	
				Hypotension and/or organ hypo-perfusion, but no SIRS	6/19 (32%)	70%	77%	32%	94%	
				Severe sepsis/septic shock	15/46 (33%)	50%	83.5%	33%	91%	
				SEWS						
				SEWS = 0	2/23 (9%)	100%	0%	14%	NC	

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr><td></td><td>197 (47)

Nursing home patients, n (%): NR

Comorbidities, n (%): NR

Pneumonia severity, n (%):
CURB-65 0 or 1:140 (33.5)
CURB-65 2: 119 (28.5)
CURB-65 ≥ 3: 160 (38)

LOS, median (range):
5 (0-116)</td><td></td><td></td><td>
<table>
<tr><td>SEWS = 1</td><td>3/29 (10%)</td><td>93%</td><td>11%</td><td>14%</td><td>91%</td></tr>
<tr><td>SEWS = 2</td><td>6/39 (15%)</td><td>83%</td><td>25%</td><td>15%</td><td>90%</td></tr>
<tr><td>SEWS = 3</td><td>3/39 (8%)</td><td>63%</td><td>42.5%</td><td>15%</td><td>62%</td></tr>
<tr><td>SEWS = 4</td><td>3/33 (9%)</td><td>53%</td><td>62%</td><td>18%</td><td>89%</td></tr>
<tr><td>SEWS = 5</td><td>4/23 (17%)</td><td>43%</td><td>78%</td><td>24%</td><td>90%</td></tr>
<tr><td>SEWS ≥ 6</td><td>9/32 (28%)</td><td>30%</td><td>88%</td><td>28%</td><td>89%</td></tr>
</table>
NC = Not calculable
1. Defined as in Table 1, main paper
2. Defined by presence or absence of: temperature < 36ºC or > 38ºC, pulse > 90/minute, respiratory rate > 20/minute and white cell count < 4 or > 12 cells per mm^3
3. Defined by above plus severe sepsis/septic shock
d) AUC (95% CI) for 30 day mortality in the CXR-confirmed cohort (218 patients):
• CURB-65: 0.79 (0.72-0.86)
• CRS65:0.75 (0.67-0.83)
• SIRS: 0.70 (0.59-0.81)
• SEWS: 0.61 (0.49-0.72)</td><td>pneumonia</td></tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Shindo et al. 2008 [42]

Study type:
Retrospective
Selection / patient setting:
Community hospital in Handa, Japan. Patients admitted to hospital with a CAP diagnosis
Addressing missing data/non reliability of data: 42 patients not evaluated due to lack of data on respiratory rate at hospital admission
Statistical analysis (including confounders adjusted for):
ROC analysis</td>
<td>Diagnosis:
CAP defined as pneumonia in a patient who was not hospitalised and was carrying on with activities of daily living.
Inclusion criteria:
Patients with diagnosis of CAP, some patients with HCAP have been included (number not given)
Exclusion criteria:
HAP
All patients,
N: 329
Exclusions reasons: NR
Included N: 329
Age, mean (SD): 75 (15.6)
Age ≥ 65 years, n (%): 270 (82.1)
Gender: male, n (%): 197 (59.9)
Nursing home patients, n (%): 80 (24.3)
Comorbidities > 10%, n (%):
• Neoplastic disease: 42 (12.8)
• Chronic pulmonary disease: 107 (32.5)
• Chronic heart failure: 40 (12.2)
• CNS disorder: 96 (29.2)
• Diabetes: 57 (17.3)
Pneumonia severity: NR
LOS, median (range): 13 (1-157)</td>
<td>• A-DROP
• CURB-65</td>
<td>•30-day mortality
•ICU admission</td>
<td>a) 30-day mortality , n (%); 31 (9.4)
b) ICU admission, n (%): 48 (14.6)
c) AUC for 30-day mortality (95% CI), all patients:
• A-DROP:0.846 (0.790-0.903)
• CURB-65: 0.835 (0.763-0.908)
d) AUC for 30-day mortality (95% CI), HCAP patients excluded:
• A-DROP:0.910 (0.844-0.976)
• CURB-65: 0.835 (0.835-0.988)
e) 30-day mortality (%) in each risk class:
<table>
<tr><th>Severity tool</th><th>30-day mortality, n (%)</th></tr>
<tr><th colspan="2">A-DROP</th></tr>
<tr><td>0</td><td>0 (0)</td></tr>
<tr><td>1</td><td>0 (0)</td></tr>
<tr><td>2</td><td>4.5 (4)</td></tr>
<tr><td>3</td><td>15.9 (11)</td></tr>
<tr><td>4</td><td>32.5 (13)</td></tr>
<tr><td>5</td><td>42.9 (3)</td></tr>
<tr><th colspan="2">CURB-65</th></tr>
<tr><td>0</td><td>0 (0)</td></tr>
<tr><td>1</td><td>1.5 (1)</td></tr>
<tr><td>2</td><td>3.9 (4)</td></tr>
<tr><td>3</td><td>9.8 (8)</td></tr>
<tr><td>4</td><td>42.9 (12)</td></tr>
<tr><td>5</td><td>42.9 (6)</td></tr>
</table>
</td>
<td>Funding:
NR

Limitations
• Data was retrospectively collected from a single institution

Additional outcomes:
Readmission within 30 days
Recurrence

Notes:
No info on number of patients with HCAP</td>
</tr>
</table>

Reference	Patient Characteristics	Risk assessment tools at admission	Outcomes measures	Results	Comments
Author and year: Brown et al. 2009[11] **Study type:** Retrospective **Selection / patient setting:** Academic tertiary hospital in Salt Lake City, USA. Patients with CAP admitted to the ED or directly admitted to hospital **Addressing missing data/non reliability of data:**. **Statistical analysis (including confounders adjusted for):** ROC analysis	**Diagnosis:** Patients admitted within 72 h with ICD-9 code compatible with a primary diagnosis of pneumonia or respiratory failure or organism-specific sepsis with a secondary diagnosis of pneumonia. Admission CXR compatible with pneumonia also required **Inclusion criteria:** Patients with a diagnosis of pneumonia excluding HCAP/HAP **Exclusion criteria:** • Primary diagnosis of aspiration pneumonia • Nursing home residents • Patients discharged from hospital within 90 days • Patients receiving chronic haemodialysis, significant immunosuppression, present/past haematological malignancies • Patients with DNR/DNI orders at admission **All patients,** N: 3287 Exclusions reasons: Dialysis: 58, DNR/DNI: 333, Died in the ED: 5, HAP (discharged from hospital within 90 days): 435, Pneumonia in the past year: 96 [some patients had more than 1 exclusion reason] **Included** N: 2413 **Age:** 56.2 (not reported if mean or median) **Gender: male, (%):** (51.4) **Nursing home patients, n (%):** NR **Comorbidities, n (%):** NR **Pneumonia severity:** CURB-65 (points): 1.1 SMART-COP (points): 1.8 IDSA/ATS minor criteria (points): 1.1 **Bacteraemia (%):** 2.3 **LOS, median (range):** NR	• CURB-65 • IDSA/ATS • SMART-COP	• SCAP (severe CAP): receipt of intensive therapy in the ICU	a) 30-day mortality , n (%); 89 (3.7) b) ICU admission, n (%): 378 (25) c) AUC for prediction of SCAP as defined in the previous column: • IDSA/ATS: 0.88 (0.85-0.90) • SMART-COP: 0.83 (0.80-0.86) • CURB-65: 0.76 (0.73-0.80)	**Funding:** National health and medical research council of Australia **Limitations** • Retrospective analysis relying on ICD-9 coding rather than prospective screening **Additional outcomes**: CURXO-80 **Notes:**

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
Author and year: Kohno et al. 2013[28] **Study type:** Prospective **Selection / patient setting:** Multicentre observational cohort study, including 128 general hospitals and 7 university hospitals in Japan. Patients ≥20 years admitted to hospital with respiratory failure (without mechanical ventilation) due to CAP **Addressing missing data/non reliability of**	**Diagnosis:** CAP was defined as pneumonia which developed acutely without a history of hospitalization or admission to long-term care facilities within 2 weeks of onset, acute infiltrates on CXR, leukocytosis, increased band cells, leukopaenia or elevated CRP, fever, respiratory symptoms or at least one abnormal finding on phonacoscopy. clinical signs and symptoms of LRTI (fever, cough, purulent sputum) in addition to new infiltrate on CXR **Inclusion criteria:** Patients with a diagnosis of CAP and acute respiratory failure **Exclusion criteria:** Non-infectious pneumonia, including interstitial pneumonia,	• PSI • A-DROP: 0 = mild 1 or 2 = moderate 3 = severe 4 or 5 = extremely severe	• 28-day mortality • ICU admission	a) 28-day mortality , n (%); 58 (12.3) b) ICU admission, n (%): 41 (8.7) c) AUC of severity tools for 28-day mortality (95% CI): • A-DROP: 0.6721 (0.5983-0.7458) • PSI: 0.6324 (0.5587-0.7061)	**Funding:** NR **Limitations** • Patients with aspiration pneumonia and HCAP were not excluded. Therefore studies that exclude these patients are required to confirm these results. • Similarly, studies that include patients without acute respiratory failure and outpatients will be required **Additional outcomes**: Requirement for mechanical ventilation No significant relationship was found between ICU admission rate and the severity of A-DROP) **Notes:**

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
data:.NR **Statistical analysis (including confounders adjusted for):** ROC analysis	pulmonary tuberculosis, organizing pneumonia and radiation pneumonitis, or patients with lung cancer. HAP (≥ 48 h of hospitalisation) **All patients,** N: 482 Exclusions reasons: NR **Included** N: 482 **Age, mean (SD):** 76.3 (12.0) **Gender: male, n (%):** 353 (73.2) **Nursing home patients, n (%):** NR **Comorbidities, n (%):** COPD: 126 (26.1) Asthma: 61 (12.7) **Pneumonia severity:** NR **LOS, median (range):** NR				

<table>
<tr><th>Reference</th><th>Patient Characteristics (based on the number of episodes, not patients)</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Chalmers et al. 2008 [15]

Study type:
Prospective

Selection / patient setting:
Patients with CAP at the NHS Lothian University Hospitals in Edinburgh, UK

Addressing missing data/non reliability of data: There were no missing data in the study

Statistical analysis (including confounders</td>
<td>Diagnosis:
CAP diagnosis was based on new infiltrate on CXR and at least 3 of the following symptoms: cough, sputum, breathlessness, pleuritic chest pain, haemoptysis, fever, headache, and signs consistent with pneumonia on chest auscultation.

Inclusion criteria:
Age < 50 years and CAP diagnosis (see above)

Exclusion criteria:
HAP, active thoracic malignancy, immunosuppression, pulmonary embolism, and patients for whom active treatment was not considered to be appropriate (those in palliative care)</td>
<td>• PSI
• CURB-65
• SMART-COP</td>
<td>• Need for intensive respiratory or vasopressor support (IRVS)</td>
<td>a) IRVS required: n (%): 33 (9.9)
b) 30-day mortality , n (%); 5 (1.5)
c) Prediction of IRVS requirement by assessment tools:
<table>
<tr><th>Severity tool</th><th>Sensitivity %</th><th>Specificity %</th><th>PPV %</th><th>NPV %</th><th>AUC (95% CI)</th></tr>
<tr><td>PSI ≥ IV</td><td>54.5</td><td>82.8</td><td>25.7</td><td>94.3</td><td>0.80 (0.75-0.84)</td></tr>
<tr><td>CURB-65 ≥ 3</td><td>54.5</td><td>89.6</td><td>34.0</td><td>95.2</td><td>0.81 (0.76-0.86)</td></tr>
<tr><td>SMART-COP > 2</td><td>84.8</td><td>82.1</td><td>34.1</td><td>98.0</td><td>0.87 (0.83-0.91)</td></tr>
</table>
</td>
<td>Funding:
JD Chalmers was supported by a Clinical research training fellowship from the Medical Research Council

Limitations: NR

Additional outcomes:

Notes:
Younger patients [All of the patients who died within 30 days had at least 1 comorbidity. Because of the low mortality rate, analysis of the severity scores was limited to the primary outcome of</td>
</tr>
</table>

Reference	Patient Characteristics (based on the number of episodes, not patients)	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
adjusted for): ROC analysis	**All patients** Number of patients: 335 Exclusions reasons: NR **Included** N: 335 **Age, median (range):** 36 (28-43) **Gender: male, n (%):** NR **Nursing home patients, n (%):** NR **Comorbidities (>5%), n (%):** Chronic liver disease: 31 (9.2) [Prevalence of other comorbidities <5%] **Pneumonia severity:** NR **LOS, median (range):** NR				requirement of mechanical ventilation and/or inotropic support]

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Salluh et al. 2008[39]
Study type:
Prospective

Selection / patient setting:
One tertiary hospital in Rio de Janeiro, Brazil. Consecutive patients with CAP requiring ICU admission

Addressing missing data/non reliability of data:
NR
Statistical analysis (including confounders adjusted for):
ROC analysis</td>
<td>Diagnosis:
CAP severity was assessed by the presence of acute organ dysfunctions and CURB-65.
Inclusion criteria:
Patients with CAP requiring ICU admission
Exclusion criteria:
Patients who had received steroids in the ED and within the previous year
All patients,
N: 99
Exclusions reasons:
• Glucocorticosteroids used in the ED: 20
• Previously used glucocorticosteroids: 7
Included N: 72
Age, median (range): 71 (52.5-83.7)
Gender: male, n (%): 34 (47.2)
Nursing home patients, n (%): NR
Comorbidities, n (%):
COPD: 7 (9.7)
Pneumonia severity, median (range):
• APACHE II: 14 (11-17)
• CURB-65: 3 (3-4)
LOS, median (range): 10 (7-18.5)</td>
<td>• CURB-65
• APACHE-II
• SOFA</td>
<td>Hospital mortality</td>
<td>a) Hospital mortality , n (%); 12 (16.7)
b) Predictive value of CURB-65 and APACHE II for hospital mortality
<table>
<tr><th>Severity tool</th><th>Sensitivity %</th><th>Specificity %</th><th>Likelihood ratio</th></tr>
<tr><td colspan="4">CURB-65</td></tr>
<tr><td>2.5</td><td>25</td><td>100</td><td>NR</td></tr>
<tr><td>3.5</td><td>56.6</td><td>75</td><td>2.27</td></tr>
<tr><td>4.5</td><td>88.3</td><td>33.3</td><td>1.32</td></tr>
<tr><td colspan="4">APACHE II</td></tr>
<tr><td>12.5</td><td>91.6</td><td>38.3</td><td>1.49</td></tr>
<tr><td>14.5</td><td>66.6</td><td>60</td><td>1.67</td></tr>
<tr><td>22</td><td>33.3</td><td>96.6</td><td>10</td></tr>
</table>
c) AUC for hospital mortality:
• CURB-65: 0.71 (0.57-0.86)
• APACHE II: 0.71 (0.56-0.86)
• SOFA: 0.62 (0.41-0.84)</td>
<td>Funding:
NR

Limitations
• Exclusion of patients who had used corticosteroids limited the population, therefore results may not be generalizable
• Single-centre study
• Small sample of severe patients, which may have affected the lack of statistical significance of AUC of CURB-65 and APACHE II

Additional outcomes:

Notes:
Population of severe patients</td>
</tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at hospital admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year:
Yang et al. 2012[48]
Study type:
Retrospective

Selection / patient setting:
One university hospital in China.
Adults with CAP admitted to hospital.

Addressing missing data/non reliability of data:
NR

Statistical analysis (including</td>
<td>Diagnosis:
CAP diagnosis was based on the presence of infiltrates on CXR, respiratory symptoms with or without pleuritic chest pain, fever, signs of consolidation of lung tissue, and/or the presence of crackling sounds and high WBC count

Inclusion criteria:
Patients with CAP (as described above)

Exclusion criteria:
Lung tumour, non-infective interstitial lung diseases, pulmonary oedema, pulmonary embolism, or pulmonary infiltration with eosinophilia and lung vasculitis</td>
<td>• PSI
• CURB-65
• Sepsis score</td>
<td>• 30-day mortality</td>
<td>a) 30-day mortality, n (%): 71 (10.5)
b) AUC for 30-day mortality:
• PSI: 0.94
• CURB-65: 0.91
• Sepsis score: 0.89

c) Mortality (%) according to severity class:
<table>
<tr><th>Severity tool</th><th>30-day mortality % (n dead/total n patients)</th></tr>
<tr><td colspan="2">PSI</td></tr>
<tr><td>I-III (low risk)</td><td>0.7 (3/461)</td></tr>
<tr><td>IV-V (high risk)</td><td>31.8 (68/214)</td></tr>
<tr><td colspan="2">CURB-65</td></tr>
<tr><td>0-1 (low risk)</td><td>2.5 (13/517)</td></tr>
<tr><td>2 (moderate risk)</td><td>14.6 (12/82)</td></tr>
<tr><td>3-5 (high risk)</td><td>60.5 (46/76)</td></tr>
<tr><td colspan="2">Sepsis score</td></tr>
<tr><td>non-sepsis (low risk)</td><td>0.4 (1/247)</td></tr>
<tr><td>sepsis (intermediate risk)</td><td>4.8 (16/332)</td></tr>
<tr><td>severe sepsis and septic shock (high risk)</td><td>56.2 (54/96)</td></tr>
</table>
</td>
<td>Funding:
NR

Limitations:
• Retrospective study
• Single centre study

Additional outcomes:</td>
</tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools at hospital admission (including thresholds used)	Outcomes measures	Results	Comments
confounders adjusted for): ROC analysis	**All patients,** N: 675 Exclusions reasons: NR **Included** N: 675 **Age, mean (SD):** 61.1 (18.1) **Gender: male, n (%):** 428 (63.4) **Nursing home patients, n (%):** NR **Comorbidities (> 10%), n (%):** • Chronic lung disease: 78 (11.6) • Chronic heart disease: 71 (10.5) • Diabetes: 71 (10.5) **Pneumonia severity:** NR **LOS, median (range):** NR				

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year: Ribeiro et al. 2013[37]

Study type: Retrospective

Selection / patient setting: Patients admitted to hospital with pneumococcal pneumonia

Addressing missing data/non reliability of data:

Statistical analysis (including confounders adjusted for): ROC analysis</td>
<td>Diagnosis:
CAP was diagnosed based on new infiltrate on CXR with symptoms and signs of acute respiratory illness, and positive for S. pneumoniae.

Inclusion criteria:
Patients with CAP due to S. pneumoniae.

Exclusion criteria:
NR

All patients,
N: 142
Exclusions reasons: NR

Included N: 142

Age, mean (SD): 58.7 (16.9)

Gender: male (%): 54.2%

Nursing home patients: NR

Comorbidities: NR

Pneumonia severity:
<table>
<tr><td>PSI low</td><td>93 (65.5%)</td></tr>
</table>
</td>
<td>• CURB65
• PSI
• SCAP
• SMART-COP</td>
<td>• Mortality
• Need for ICU admission</td>
<td>• Mortality, n (%): 2 (1.4)
• Need for ICU admission, n (%): 22 (15.5)
<table>
<tr><th>Score</th><th>Mortality</th><th>Need for ITU admission</th></tr>
<tr><td>PSI low</td><td>0 (0)</td><td>10 (10.8%)</td></tr>
<tr><td>PSI medium</td><td>0 (0)</td><td>8 (21.6%)</td></tr>
<tr><td>PSI high</td><td>2 (16.7%)</td><td>4 (33.3%)</td></tr>
<tr><td>CURB65 low</td><td>0 (0)</td><td>8 (8.3%)</td></tr>
<tr><td>CURB65 medium</td><td>0 (0)</td><td>9 (28.1%)</td></tr>
<tr><td>CURB65 high</td><td>2 (15.4%)</td><td>5 (38.5%)</td></tr>
<tr><td>SCAP low</td><td>0 (0)</td><td>2 (2.8%)</td></tr>
<tr><td>SCAP medium</td><td>0 (0)</td><td>8 (14.6%)</td></tr>
<tr><td>SCAP high</td><td>2 (13.3%)</td><td>12 (80%)</td></tr>
<tr><td>SMART-COP low</td><td>0 (0)</td><td>4 (4.2%)</td></tr>
<tr><td>SMART-COP medium</td><td>1 (2.8%)</td><td>7 (19.4%)</td></tr>
<tr><td>SMART-COP high</td><td>1 (9.1%)</td><td>11 (100%)</td></tr>
</table>
• Predictive value for mortality:
<table>
<tr><th>Score</th><th>Sensitivity</th><th>Specificity</th><th>NPV</th><th>AUC (95% CI)</th></tr>
<tr><td>PSI > III</td><td>1</td><td>0.66</td><td>1</td><td>0.96 (0.92-1)</td></tr>
<tr><td>CURB65 > 1</td><td>1</td><td>0.69</td><td>1</td><td>0.96 (0.92-1)</td></tr>
<tr><td>SCAP > 10</td><td>1</td><td>0.51</td><td>1</td><td>0.95 (0.91-1)</td></tr>
<tr><td>SMART-COP > 2</td><td>1</td><td>0.68</td><td>1</td><td>0.88 (0.74-1)</td></tr>
</table>
</td>
<td>Funding:
NR

Limitations
• Population limited to patients with pneumococcal pneumonia
• Retrospective design

Additional outcomes:

Notes:</td>
</tr>
</table>

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr><td></td><td>
<table>
<tr><td>PSI medium</td><td>37 (26.1%)</td></tr>
<tr><td>PSI high</td><td>12 (8.4%)</td></tr>
<tr><td>CURB65 low</td><td>97 (68.3%)</td></tr>
<tr><td>CURB65 medium</td><td>32 (22.5%)</td></tr>
<tr><td>CURB65 high</td><td>13 (9.2%)</td></tr>
<tr><td>SCAP low</td><td>72 (50.7%)</td></tr>
<tr><td>SCAP medium</td><td>55 (38.7%)</td></tr>
<tr><td>SCAP high</td><td>15 (10.6%)</td></tr>
<tr><td>SMART-COP low</td><td>95 (66.9%)</td></tr>
<tr><td>SMART-COP medium</td><td>36 (25.3%)</td></tr>
<tr><td>SMART-COP high</td><td>11 (7.8%)</td></tr>
</table>
LOS, mean (SD): 13.9 (9.9)</td><td></td><td></td><td>• Predictive value for ITU admission:
<table>
<tr><th>Score</th><th>Sensitivity</th><th>Specificity</th><th>NPV</th><th>AUC (95% CI)</th></tr>
<tr><td>PSI > III</td><td>0.55</td><td>0.69</td><td>0.89</td><td>0.62 (0.49-0.76)</td></tr>
<tr><td>CURB65 > 1</td><td>0.64</td><td>0.74</td><td>0.92</td><td>0.70 (0.57-0.82)</td></tr>
<tr><td>SCAP > 10</td><td>0.91</td><td>0.58</td><td>0.97</td><td>0.85 (0.75-0.95)</td></tr>
<tr><td>SMART-COP > 2</td><td>0.82</td><td>0.76</td><td>0.96</td><td>0.85 (0.74-0.96)</td></tr>
</table></td><td></td></tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
Author and year: Xiao et al. 2013[47] **Study type:** Retrospective **Selection / patient setting:** Consecutive patients with CAP admitted to ICU in a general hospital in China **Addressing missing data/non reliability of data:** **Statistical analysis (including confounders adjusted for):** ROC analysis	**Diagnosis:** CAP was diagnosed based on new infiltrate on CXR with symptoms and signs of a LRTI in a patient who was not hospitalised or in a healthcare facility in the previous 14 days **Inclusion criteria:** Patients aged ≥ 65 years with a diagnosis of CAP as defined above. **Exclusion criteria:** • Age < 65 • Evidence of HAP, or admitted to the hospital in the previous 14 days, and onset of pneumonia symptoms beyond 48 h after admission • Infiltrate on CXR followed by obstructive pneumonia resulting from malignancy, pulmonary oedema, pulmonary embolism, or non-infectious pneumonia • Patients with severe immunosuppression and taking immune-suppressing drugs. **All patients,** N: 240 Exclusions reasons: NR	• CURB65 • PSI • APACHE II	28-day mortality	AUC for 28-day mortality in ICU patients: • CURB65: 0.810 • PSI: 0.868 • APACHE II: 0.860	**Funding:** NR **Limitations** • Study focused on elderly patients with high comorbidity burden • Retrospective design **Additional outcomes**: **Notes:** All patients were treated with standard antibiotic therapy according to BTS guidelines

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
	Included N: 240 **Age, mean (SD):** 75 (8) **Gender: male (%):** 59.6 **Nursing home patients:** excluded **Comorbidities > 10%, n (%):** • Cerebrovascular disease: 50 (20) • COPD: 84 (35) • Cardiac functional insufficiency: 51 (21) • Diabetes: 67 (28) • CKD: 35 (14.5) **Pneumonia severity – survivor/non-survivor:** • CURB65: 2/3 • PSI: 104/151 • APACHE II: 13/22 **LOS in ICU, mean (range) – survivor/non-survivor:** 15 (10-22)/11 (7-15)				

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
Author and year: Dwyer et al. 2011[19] **Study type:** Retrospective **Selection / patient setting:** Patients with bacteriaemic pneumococcal CAP prospectively recruited in a previous multicentre study in 3 hospitals in Sweden **Addressing missing data/non reliability of data:** **Statistical**	**Diagnosis:** CAP was diagnosed based on new infiltrate on CXR and pneumococcal bacteraemia **Inclusion criteria:** Patients aged ≥18 years with a diagnosis of CAP and pneumococcal bacteriaemia as defined above. **Exclusion criteria:** • Patients admitted to hospital in the previous month **All patients,** N: 375 Exclusions reasons: NR **Included** N: 375 **Age, median (range):** survivors – 62.0 (18-98), non-survivors – 75 (38-93 **Gender: female (%):** 49.6 **Nursing home patients:** 3.2% **Comorbidities > 10%, n (%):**	• CURB65 • PSI • CRB65	30-day mortality	30-day mortality n (%): 35 (9) AUC for 30-day mortality: • PSI: 0.84 • CURB65: 0.81 • CRB65: 0.77 **PSI score** / **30-day Mortality, n (%)** I (n = 48) — 0 II (n = 68) — 0 III (n = 75) — 4 (5) IV (n = 117) — 6 (5) V (n = 67) — 25 (37) **CURB 65 score** / **30-day Mortality, n (%)** 0 (n = 87) — 0 1 (n = 111) — 6 (5) 2 (n = 100) — 6 (6) 3 (n = 56) — 12 (21) 4 (n = 19) — 9 (47) 5 (n = 2) — 2 (100) **CRB 65 score** / **30-day Mortality, n (%)** 0 (n = 97) — 3 (3) 1 (n = 140) — 6 (4) 2 (n = 100) — 10 (10)	**Funding:** NR **Limitations** • Only patients with bacteraemic pneumococcal pneumonia were included • Retrospective design • Serum creatinine was used instead of serum urea for PSI and CURB65 **Additional outcomes**: **Notes:** All patients were treated with standard antibiotic therapy according to BTS guidelines

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
analysis (including confounders adjusted for): ROC analysis	• Any cardiac disease: 112 (30) • Pulmonary disease: 64 (17) **LOS in ITU, mean (range) – survivor/non-survivor:** 15 (10-22)/11 (7-15)			3 (n = 36) 14 (39) 4 (n = 2) 2 (100)	

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
Author and year: Chalmers et al. 2011 [16] **Study type:** Prospective study **Selection / patient setting:** Unselected patients with CAP admitted to NHS Lothian hospitals in Scotland, UK **Addressing missing data/non reliability of data:** **Statistical analysis (including confounders adjusted for):** ROC analysis	**Diagnosis:** CAP was diagnosed based on new infiltrate on CXR and three or more symptoms and sign consistent with pneumonia **Inclusion criteria:** Patients with a diagnosis of CAP as defined above. **Exclusion criteria:** • HAP • Radiographic changes due to lung cancer rather than pneumonia • Patients with systemic immunosuppression, HIV-infection, solid organ transplant, or pulmonary tuberculosis • Patients requiring mechanical ventilation/vasopressor support in the emergency department, or patients with do-not-attempt-resuscitation orders **All patients,** N: 1062 Exclusions reasons: NR **Included** N: 1062 **Age, median (range):** 63 (47-74)	• IDSA/ATS minor criteria • PSI • CURB65 • CRB65 • SMART-COP • SCAP • ATS minor criteria 2001	• 30-day mortality • ICU admission	30-day mortality, n (%): 48 (4.5) AUC (95% CI) for predicting ICU admission: • IDSA/ATS minor criteria: 0.85 (0.82 to 0.85) • PSI: 0.74 (0.71 to 0.77) • CURB65: 0.74 (0.71 to 0.78) • CRB65: 0.73 (0.69 to 0.76) • SMART-COP: 0.85 (0.83 to 0.88) • SCAP: 0.75 (0.72 to 0.78) • ATS minor criteria 2001: 0.70 (0.67 to 0.73) AUC (95% CI) for predicting 30-day mortality: • IDSA/ATS minor criteria: 0.78 (0.74 to 0.82) • PSI: 0.81 (0.78 to 0.85) • CURB65: 0.74 (0.70 to 0.78) • CRB65: 0.73 (0.68 to 0.77) • SMART-COP: 0.79 (0.75 to 0.83) • SCAP: 0.74 (0.70 to 0.78) • ATS minor criteria 2001: 0.68 (0.63 to 0.72)	**Funding:** Medical research council, UK **Limitations** • Study focused on patients without major criteria for ICU admission but who were eligible to ICU admission if required **Additional outcomes**: Predictive value of individual components of IDSA/ATS criteria **Notes:**

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
	Gender: male (%): 48.3 **Nursing home patients:** NR **Comorbidities > 10%, n (%):** None > 10% **Pneumonia severity , mean (SD)** • CURB65: 1.7 (1.58) • PSI: 3.0 (1.52) **LOS, median days:** 5 (2- 10)				

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
Author and year: Kasamatsu et al. 2012[26] **Study type:** Prospective study **Selection / patient setting:** Adult patients with CAP admitted to two Japanese hospitals **Addressing missing data/non reliability of data:** **Statistical analysis (including confounders adjusted for):** ROC analysis	**Diagnosis:** NR **Inclusion criteria:** Adult patients with a diagnosis of CAP **Exclusion criteria:** • Patients with mild CAP • Patients with moderate CAP who refused continuous hospitalisation • Immunosuppressed patients who were receiving chemotherapy or immunosuppressant therapy • Patients who could not be followed up or with diagnosis suspected to be inaccurate **All patients,** N: 226 Exclusions reasons: incomplete data **Included** N: 170 **Age, mean (SD):** 67.9 (18.1) **Gender: male (%):** 57.6 **Nursing home patients:** NR **Comorbidities > 10%, n (%):** • Cerebrovascular disease: 26 (15.3) • COPD: 26 (15.3)	• A-DROP • CURB65 • PSI	• 30-day mortality	30-day mortality, n (%): 20 (11.8) AUC (95% CI) for predicting 30-day mortality: • A-DROP: 0.88 (0.82 to 0.94) • CURB65: 0.88 (0.82 to 0.94) • PSI: 0.89 (0.85 to 0.94)	**Funding:** NR **Limitations** • Only patients with moderate to severe CAP included • Criteria for hospitalisation differed from those used in other countries, depending on the physician's subjective assessment of the severity of dehydration **Additional outcomes**: **Notes:**

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
	Pneumonia severity , n patients: • A-DROP 3-5 (severe): 57 • CURB65 3-5 (severe): 61 • PSI IV-V (severe): 96 **LOS, median days:** NR				

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year: Robins-Browne et al. 2012[38]

Study type: Prospective study

Selection / patient setting: Patients with CAP admitted via ED to a tertiary hospital in Australia

Addressing missing data/non reliability of data:

Statistical analysis (including confounders adjusted for): ROC analysis</td>
<td>Diagnosis:
CAP was diagnosed based on new infiltrate on CXR or CT scan, and two or more symptoms and sign consistent with pneumonia

Inclusion criteria:
Adults aged > 18 years with a diagnosis of CAP as defined above.

Exclusion criteria:
• Aspiration pneumonia
• Immunosuppression
• Active orders limiting life-sustaining treatment
• Hospitalisation for more than 48 hours prior to hospital admission or within the last 14 days, or direct admission to ICU

All patients,
N: 367
Exclusions reasons: NR

Included N: 367

Age, mean (IQR): (47-74)

Gender: male (%): 52%

Nursing home patients: NR</td>
<td>• SMART-COP
• PSI
• CORB</td>
<td>• 30-day mortality
• IRVS (intensive respiratory or vasopressor support) requirement</td>
<td>30-day mortality, n (%): 10 (3)
<table>
<tr><th>Severity tool</th><th>IRVS, n (%)</th><th>30-day mortality, n (%)</th></tr>
<tr><td>SMART-COP</td><td></td><td></td></tr>
<tr><td>0-2</td><td>1 (0.4)</td><td>1 (0.4)</td></tr>
<tr><td>3-4</td><td>18 (20)</td><td>3 (3.2)</td></tr>
<tr><td>≥ 5</td><td>18 (44)</td><td>6 (15)</td></tr>
<tr><td>PSI</td><td></td><td></td></tr>
<tr><td>I-II</td><td>8 (4)</td><td>1 (0.5)</td></tr>
<tr><td>III</td><td>5 (6)</td><td>1 (1.1)</td></tr>
<tr><td>≥ IV</td><td>24 (31)</td><td>8 (10)</td></tr>
<tr><td>CORB</td><td></td><td></td></tr>
<tr><td>0-1</td><td>25 (7.5)</td><td>5 (1.5)</td></tr>
<tr><td>≥ 2</td><td>12 (36)</td><td>5 (15)</td></tr>
</table>
AUC (95% CI) for predicting IRVS:
• SMART-COP ≥ 3: 0.89 (0.86 to 0.93)
• PSI ≥ IV: 0.76 (0.68 to 0.85)
• CORB ≥ 2: 0.69 (0.60 to 0.78)</td>
<td>Funding:
NR

Limitations
• Study conducted in a single centre
• Only 36% of pneumonia presentations were prospectively identified and enrolled by ED staff, which could have limited the number enrolled

Additional outcomes:

Notes:</td>
</tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
	Comorbidities > 10%, n (%): • COPD: 108 (29.4) • Diabetes: 73 (19.9) **Pneumonia severity, n (%)** • SMART-COP ≥ 5: 41 (11.2) • PSI ≥ IV: 78 (21.2) • CORB ≥2: 33 (9.0) **LOS:** NR				

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year: Chen et al. 2010[18]

Study type: Prospective study

Selection / patient setting: Patients with CAP admitted via ED to a university hospital in Taiwan

Addressing missing data/non reliability of data:

Statistical analysis (including confounders adjusted for): ROC analysis</td>
<td>Diagnosis:
CAP was diagnosed based on new infiltrate on CXR and symptoms and sign consistent with pneumonia

Inclusion criteria:
Adults aged > 18 years with a diagnosis of CAP as defined above.

Exclusion criteria:
• HAP (development of pneumonia > 48 hours after hospital admission)

All patients,
N: 987
Exclusions reasons: NR

Included N: 987

Age- stratified as:
• younger adults, 18 to 64 years (348)
• elderly, 65 to 84 years (438)
• very old, ≥ 85 years (201)

Gender: male (%): 61.9

Nursing home patients: NR

Comorbidities > 10%, n (%):
• Diabetes: 181 (18.3)
• Cerebrovascular event: 121 (12.2)</td>
<td>• PSI
• CURB65</td>
<td>• 30-day mortality</td>
<td>30-day mortality, n (%): 68 (6.8)
<table>
<tr><th>Severity tool</th><th>30-day mortality, n (%)</th><th>AUC (95% CI) for 30-day mortality</th></tr>
<tr><td colspan="3">PSI</td></tr>
<tr><td>I-II</td><td>1 (0.4)</td><td rowspan="3">0.83 (0.78 to 0.87)</td></tr>
<tr><td>III</td><td>1 (0.5)</td></tr>
<tr><td>≥ IV</td><td>66 (12.5)</td></tr>
<tr><td colspan="3">CURB65</td></tr>
<tr><td>0-1</td><td>12 (2.4)</td><td rowspan="3">0.73 (0.67 to 0.79)</td></tr>
<tr><td>2</td><td>23 (7.8)</td></tr>
<tr><td>3-5</td><td>33 (16.6)</td></tr>
</table>
</td>
<td>Funding:
NR

Limitations
• Study conducted in a single centre

Additional outcomes: subgroup analyses by age group

Notes:</td>
</tr>
</table>

Reference	Patient Characteristics	Risk Assessment tools at admission (including thresholds used)	Outcomes measures	Results	Comments
	• COPD: 140 (14.2) • Heart failure: 129 (13.0) • Non-haematogenous malignancies: 151 (15.3) **Pneumonia severity, mean** • Elderly/very old, PSI: 4, CURB65: 2 • Younger adults, PSI: 2, CURB65: 0 **LOS, days:** • Elderly: 8 (1 to 16) • Very old: 9 (2 to 17) • Younger adults: 1 (0 to 10)				

<table>
<tr><th>Reference</th><th>Patient Characteristics</th><th>Risk Assessment tools at admission (including thresholds used)</th><th>Outcomes measures</th><th>Results</th><th>Comments</th></tr>
<tr>
<td>Author and year: Schuetz et al 2010/2011[40,41]

Study type: Prospective study
Selection / patient setting: Patients with CAP enrolled in the multicentre ProHOSP study in Switzerland
Addressing missing data/non reliability of data:

Statistical analysis (including confounders adjusted for): ROC analysis</td>
<td>Diagnosis:
CAP was diagnosed based on new infiltrate on CXR
Inclusion criteria:
Adults aged > 18 years with a diagnosis of CAP as defined above.
Exclusion criteria:
• Patients with dementia, immunosuppression, concomitant infections and active IV drug abuse
All patients,
N: 925
Exclusions reasons: NR
Included N: 925
Age, median (range): 73 (58-82)
Gender: male (%): 59
Nursing home patients: NR
Comorbidities > 10%, n (%):
• Chronic heart failure: 159 (17)
• Renal failure: 206 (22)
• COPD: 282 (30)

Pneumonia severity, n (%)
• PSI ≥IV: 473 (51.1)
• CURB65 ≥3: 160 (17)
LOS, days, median (range): 8 (5-13)</td>
<td>• PSI
• CURB65</td>
<td>• 30-day mortality
• ICU admission</td>
<td>30-day mortality (5.4%)
<table>
<tr><th>Severity tool</th><th>30-day mortality, n (%)</th><th>AUC (95% CI) for 30-day mortality</th></tr>
<tr><td colspan="3">PSI</td></tr>
<tr><td>I-II</td><td>0</td><td rowspan="3">0.79 (0.75 to 0.84)</td></tr>
<tr><td>III</td><td>1 (0.6)</td></tr>
<tr><td>≥ IV</td><td>49 (9.7)</td></tr>
<tr><td colspan="3">CURB65</td></tr>
<tr><td>0-1</td><td>4 (0.9)</td><td rowspan="3">0.72 (0.65 to 0.78)</td></tr>
<tr><td>2</td><td>25 (8.4)</td></tr>
<tr><td>3-5</td><td>21 (10.4)</td></tr>
</table>
ICU admission (9.0%)
AUC (95% CI) for ICU admission:
• PSI: 0.65 (0.59 to 0.71)
• CURB65: 0.64 (0.58 to 0.70)</td>
<td>Funding:
NR

Limitations
• Exclusion of patients with dementia, immunosuppression, concomitant infections and active IV drug abuse may limit generabisability
• Indications for ICU admission may vary between physicians, hospitals and countries

Additional outcomes:

Notes: Main focus of the study was the evaluation of PCT as a prognostic marker</td>
</tr>
</table>

2 References

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