Research Article

Comparative Evaluation of Curb-65 And Smart-Cop For Severity Assessment and 30 Day Mortality Prediction in Community Acquired Pneumonia: A Prospective Observational Cohort Study

Dr. Devanshi Naresh Kantharia[1], Dr. Hardik Hareshbhai Solanki[2], Dr. Princekumar Prafulbhai Fefar[3], Dr. Hitarthi M. Joshi[4], Dr. Bhavya H. Patel[5], Dr. Harsh Alkesh Nimbark[6]

1. Resident Doctor, Department of Medicine, Surat Municipal Institute of Medical Education and Research (SMIMER), Surat, Gujarat, India.
2. Resident Doctor, Department of Medicine, Surat Municipal Institute of Medical Education and Research (SMIMER), Surat, Gujarat, India.
3. Resident Doctor, Department of General Medicine, SGT Medical College Hospital & Research Institute, Gurugram, Haryana, India.
4. Senior Medical Officer, Department of Pharmacology, Venus Women's Hospital, Himmatnagar, Gujarat, India.
5. Medical Officer, Nilkanth Children Hospital, Ghodasar, Ahmedabad, Gujarat, India.
6. Clinical Assistant, Accord Hospital, Bhuj, Kutch, Gujarat, India.

Corresponding author: Dr. Devanshi Naresh Kantharia, Email: devanshikantharia1510@gmail.com

ABSTRACT

Objective: To compare CURB-65 and SMART-COP for severity assessment, risk categorisation and prediction of 30 day mortality in adults with community acquired pneumonia.

Methods: This prospective observational cohort study included 104 adults with clinical and radiological evidence of community acquired pneumonia at a tertiary care centre. CURB-65 and SMART-COP were calculated at presentation. Clinical findings, oxygenation, laboratory parameters, arterial blood gas findings and chest radiography were recorded. Patients were followed for 30 days.

Results: Overall mortality was 37.5% (39/104). Non survivors were older than survivors (median 55 versus 45 years, P = 0.006) and had higher pulse and respiratory rate, lower blood pressure and markedly lower room air oxygen saturation (all P < 0.001). Median CURB-65 was 0 in survivors and 2 in non survivors (P < 0.001). Median SMART-COP was 2 in survivors and 6 in non survivors (P < 0.001). All deaths occurred at SMART-COP scores of 5 or above, with deaths concentrated in the high and very high risk categories. Bilateral and multizone chest radiographic involvement were also strongly associated with mortality.

Conclusion: Both scores showed strong association with outcome. CURB-65 provided simple bedside risk stratification, whereas SMART-COP produced clearer separation of the highest risk patients in this cohort. Formal receiver operating characteristic analysis was not available, so comparative superiority in predictive accuracy should not be inferred from these data alone.

Keywords: community acquired pneumonia; CURB-65; SMART-COP; severity assessment; mortality; risk stratification.

INTRODUCTION

Community acquired pneumonia (CAP) remains an important cause of adult hospitalisation and mortality worldwide. Its clinical spectrum ranges from mild disease suitable for outpatient treatment to respiratory failure, shock and death. Early identification of patients at risk of deterioration is therefore central to site of care decisions and timely escalation of treatment [1].

Current clinical guidance recommends combining clinical judgement with validated severity assessment tools [2,3]. Mortality focused models such as the Pneumonia Severity Index [4] and CURB-65 [5] are useful for estimating prognosis and guiding admission decisions, while physiological severity remains critical for recognising patients who may require intensive care.

CURB-65 is based on confusion, urea, respiratory rate, blood pressure and age 65 years or older. It is widely used because it is rapid and practical at the bedside [5]. SMART-COP was developed to predict the need for intensive respiratory or vasopressor support and incorporates systolic blood pressure, multilobar involvement, albumin, respiratory rate, tachycardia, confusion, oxygenation and arterial pH [6]. These additional physiological variables may identify severe respiratory and circulatory compromise not fully captured by a mortality focused score.

The comparative performance of severity scores varies across populations and according to the outcome being studied. A score that predicts mortality may not necessarily provide the same information about impending need for intensive respiratory or vasopressor support. Local validation is therefore useful in tertiary care settings where disease severity and referral patterns may differ.

The objective of the present study was to evaluate and compare CURB-65 and SMART-COP for severity assessment, risk categorisation and prediction of 30 day mortality among adults with community acquired pneumonia at a tertiary care centre.

MATERIALS AND METHODS

Study design and setting

This was a prospective observational cohort study with 30 day follow up conducted in the Department of General Medicine at Surat Municipal Institute of Medical Education and Research, Surat, Gujarat, India. Adult patients with suspected CAP were screened through the casualty, emergency service or outpatient department and managed according to institutional protocols.

Study period: The study, including the 30 day follow up period, was conducted from September 2025 to February 2026.

Study population and eligibility

Adults aged 18 years or older with clinical and radiological features of CAP were eligible. CAP was defined as an acute infection of the pulmonary parenchyma acquired outside the hospital or diagnosed within 48 hours of admission, with a new infiltrate on chest radiograph and at least one compatible feature such as cough, fever above 38 °C, dyspnoea or sputum production. The protocol additionally required at least three clinical presentations or signs suggestive of CAP.

Patients with hospital acquired pneumonia or ventilator associated pneumonia, immunocompromised status including HIV infection, transplant, malignancy, immunosuppressive therapy, chemotherapy or post splenectomy status, tuberculosis, COVID 19 pneumonia, noninfectious pulmonary infiltrates, refusal to participate or incomplete 30 day follow up were excluded.

Sampling and sample size

Consecutive sampling was used. All eligible patients presenting during the study period were screened and enrolled after written informed consent. The final sample size was 104 patients, as specified in the study protocol and dissertation.

Clinical assessment and scoring

At presentation, demographic details, symptoms, general and systemic examination findings, vital parameters and room air oxygen saturation were recorded. Routine laboratory testing included haemoglobin, total leukocyte count, platelet count, urea and serum albumin. Arterial blood gas analysis included pH, partial pressure of oxygen and partial pressure of carbon dioxide. Chest radiography was evaluated for laterality, involved zones and multilobar involvement.

CURB-65 was calculated from confusion, urea above 7 mmol/l, respiratory rate 30/min or more, systolic blood pressure below 90 mmHg or diastolic blood pressure 60 mmHg or less, and age 65 years or older. SMART-COP was calculated from systolic blood pressure, multilobar chest radiographic involvement, albumin, respiratory rate, tachycardia, confusion, oxygenation and arterial pH. The need for intensive respiratory or vasopressor support and intensive care admission was recorded in the study proforma.

Outcome assessment

Patients were followed for 30 days from enrolment. Follow up after discharge was performed through outpatient visits or telecommunication. The reported final outcomes were cured without complication, cured with residual complication and death. For the present manuscript, the primary analysed clinical outcome was mortality up to 30 days, with all reported deaths occurring during the index hospital admission.

Statistical analysis

Data were entered in Microsoft Excel 2016 and analysed using SPSS version 20 and OpenEpi version 3.1. The dissertation statistical plan specifies frequency and percentage for categorical data, mean and standard deviation for continuous data, chi square testing for qualitative variables and t testing for quantitative variables, with $P < 0.05$ considered statistically significant. In the reported results, several continuous variables were presented as medians and interquartile ranges. The exact inferential test used for these median comparisons should be verified against the final SPSS output before journal submission.

Ethical considerations

The study was approved by the Institutional Ethics Committee of Surat Municipal Institute of Medical Education and Research, Surat. The approval letter bears SMIMER/IEC/OUT/NO. 105 dated 10 January 2026. Written informed consent was obtained from patients or legally authorised representatives. Confidentiality was maintained through unique study identifiers, and participation did not alter standard clinical management.

RESULTS

A total of 104 patients with CAP were analysed. The median age was 51.5 years (interquartile range 36 to 61.5), and 59 patients (56.7%) were male. Overall in hospital mortality was 37.5% (39/104), while 65 patients (62.5%) survived to discharge. Baseline demographic and clinical characteristics are summarised in Table 1.

Table 1: Demographic and clinical profile of the study population

Characteristic	Value
Age, median (IQR), years	51.5 (36 to 61.5)
Age below 40 years, n (%)	30 (28.8)
Age 40 to 59 years, n (%)	41 (39.4)
Age 60 years or older, n (%)	33 (31.7)
Male, n (%)	59 (56.7)
Female, n (%)	45 (43.3)
Cough, n (%)	103 (99.0)
Fever, n (%)	85 (81.7)
Shortness of breath, n (%)	47 (45.2)
Expectoration, n (%)	46 (44.2)
Pleuritic chest pain, n (%)	35 (33.7)
Altered mentation, n (%)	37 (35.6)
Bilateral chest radiographic opacities, n (%)	32 (30.8)
Multizone chest radiographic involvement, n (%)	34 (32.7)
In hospital death, n (%)	39 (37.5)

IQR: interquartile range. Multizone involvement denotes involvement of two or more radiographic zones.

Clinical and physiological factors associated with mortality

Non survivors were older than survivors (median 55 versus 45 years, P = 0.006). Shortness of breath and pleuritic chest pain were markedly more common among non survivors, and altered consciousness and disorientation were strongly associated with mortality. Bilateral respiratory findings and crepitations were also more frequent among patients who died.

Physiological separation between outcome groups was pronounced. Non survivors had higher pulse rate, lower systolic and diastolic blood pressure, higher respiratory rate and lower room air oxygen saturation. Laboratory findings in non survivors included higher leukocyte count and urea, lower haemoglobin, platelet count and albumin, and more severe acidosis and hypoxaemia. Key continuous variables are shown in Table 2.

Table 2: Major physiological and laboratory variables according to survival status

Variable	Survivors (n = 65)	Non survivors (n = 39)	P value
Age, years	45	55	0.006
Pulse rate, beats/min	102	128	<0.001**
Systolic blood pressure, mmHg	122	92	<0.001**
Diastolic blood pressure, mmHg	78	62	<0.001**
Respiratory rate, breaths/min	28	30	<0.001**
SpO_2 on room air, %	94	84	<0.001**
Haemoglobin, g/dl	12.7	11.0	<0.001**
Total leukocyte count, /µl	11 340	18 730	<0.001**
Platelet count, $\times 10^3$/µl	274	108	<0.001**
Urea, mg/dl	25	47	<0.001**
Serum albumin, g/dl	3.3	3.1	<0.001**
Arterial pH	7.38	7.20	<0.001**
PaO_2, mmHg	100	70	<0.001**
$PaCO_2$, mmHg	32	35	0.540
Length of hospital stay, days	6	2.5	<0.001**

Values are the reported group medians in the dissertation result section. *P < 0.05, **P < 0.01. SpO_2: peripheral oxygen saturation; PaO_2: arterial partial pressure of oxygen; $PaCO_2$: arterial partial pressure of carbon dioxide.

CURB-65 and outcome

The overall median CURB-65 score was 1 (IQR 0 to 2). Survivors had a median score of 0 (IQR 0 to 1), whereas non survivors had a median score of 2 (IQR 1 to 3), with a significant association between score and outcome (P < 0.001). The score distribution is shown in Table 3 and fig. 1.

Table 3: CURB-65 score distribution and mortality

CURB-65 score	Total, n	Survivors, n	Deaths, n	Mortality, %
0	47	46	1	2.1
1	27	13	14	51.9
2	11	3	8	72.7
3	14	3	11	78.6
4	5	0	5	100.0

Overall association between CURB-65 score and mortality: P < 0.001.

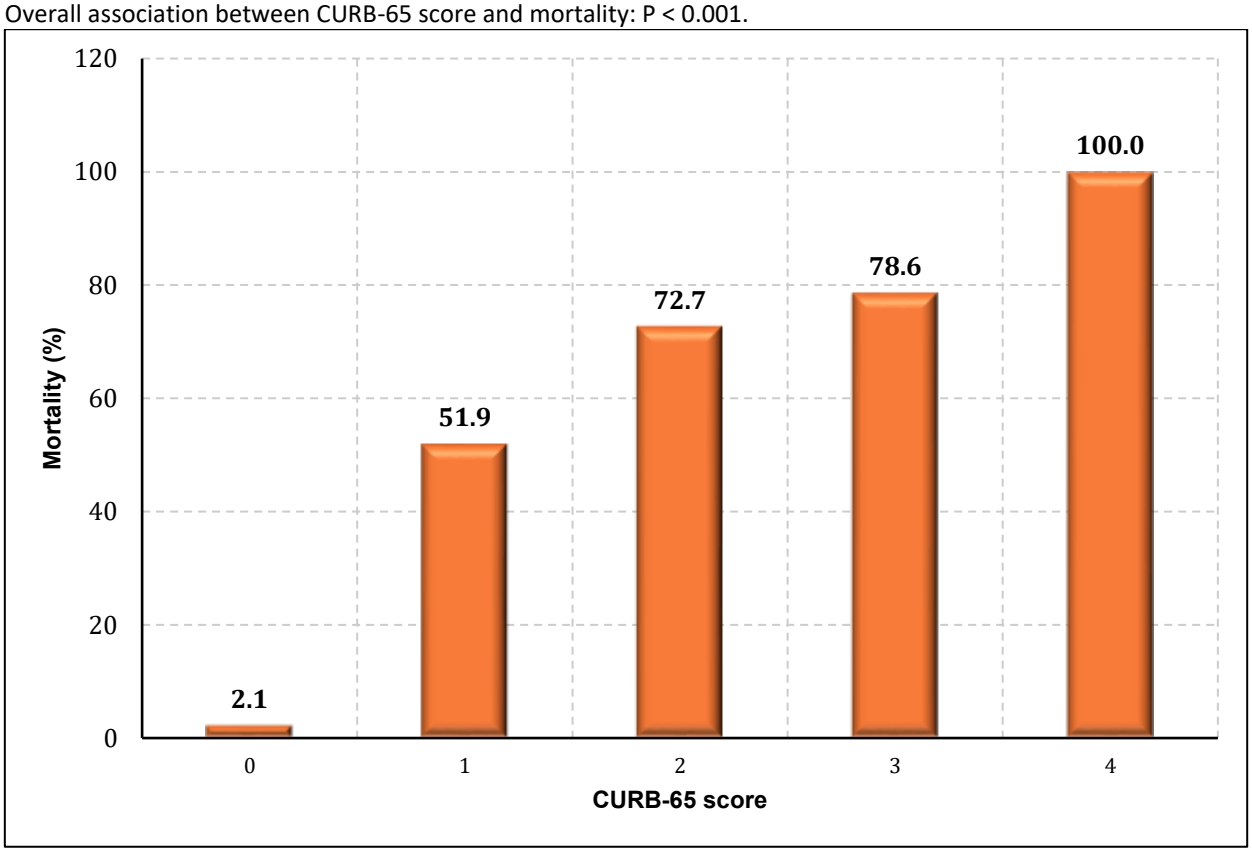


Fig. 1: Mortality according to CURB-65 score

SMART-COP and outcome

The overall median SMART-COP score was 3 (IQR 2 to 6). Survivors had a median score of 2 (IQR 1 to 3), while non survivors had a median score of 6 (IQR 6 to 7), P < 0.001. All reported deaths occurred at SMART-COP scores of 5 or above. Mortality was confined to the high and very high risk categories, as shown in Table 4 and fig. 2.

Table 4: SMART-COP risk categories according to survival status

SMART-COP category	Total, n (%)	Survivors, n	Deaths, n	Mortality, %
Low risk	42 (40.4)	42	0	0.0
Moderate risk	20 (19.2)	20	0	0.0
High risk	22 (21.2)	1	21	95.5
Very high risk	20 (19.2)	2	18	90.0

Association between SMART-COP risk category and mortality: P < 0.001.

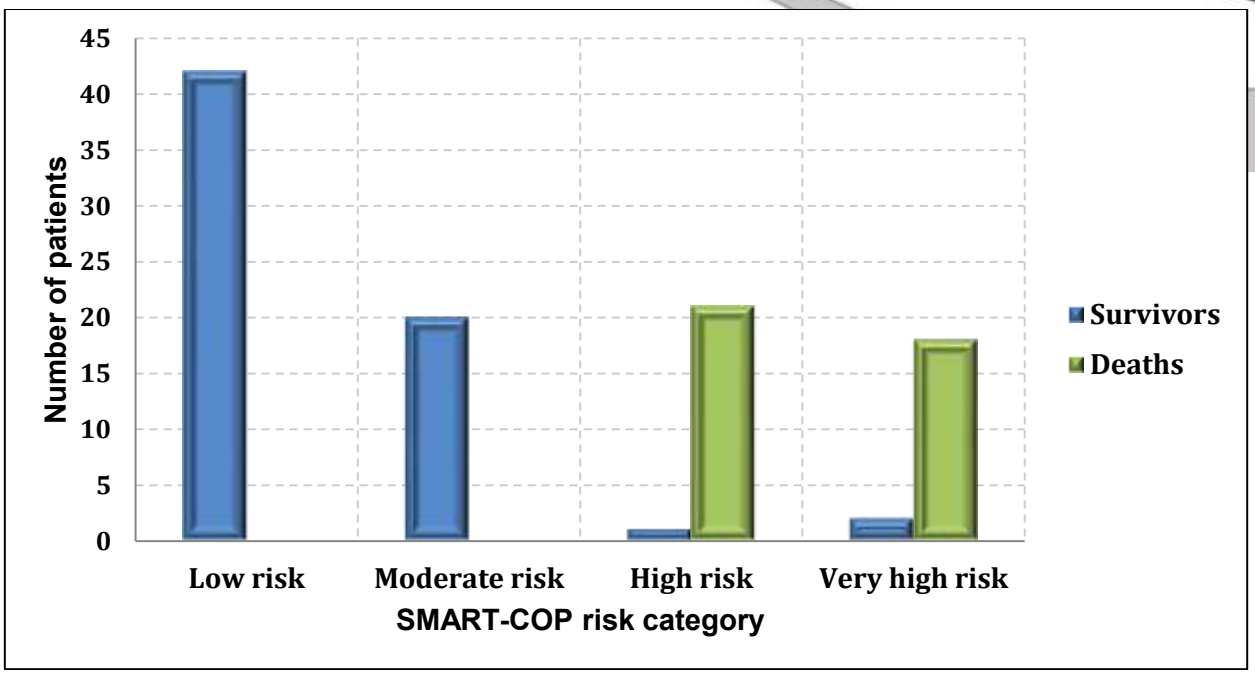


Fig. 2: Survival status according to SMART-COP risk category

Radiological findings and final outcome

Chest radiography showed right sided opacities in 40 patients (38.5%), left sided opacities in 32 (30.8%) and bilateral opacities in 32 (30.8%). Bilateral involvement was present in 64.1% of non survivors compared with 10.8% of survivors ($P < 0.001$). Multizone disease was also more frequent among non survivors (53.8% versus 20.0%, $P < 0.001$).

At 30 day monitoring, 34 patients (32.7%) were cured without complication, 31 (29.8%) were cured with residual complication and 39 (37.5%) had died in hospital. The outcome distribution is shown in fig. 3.

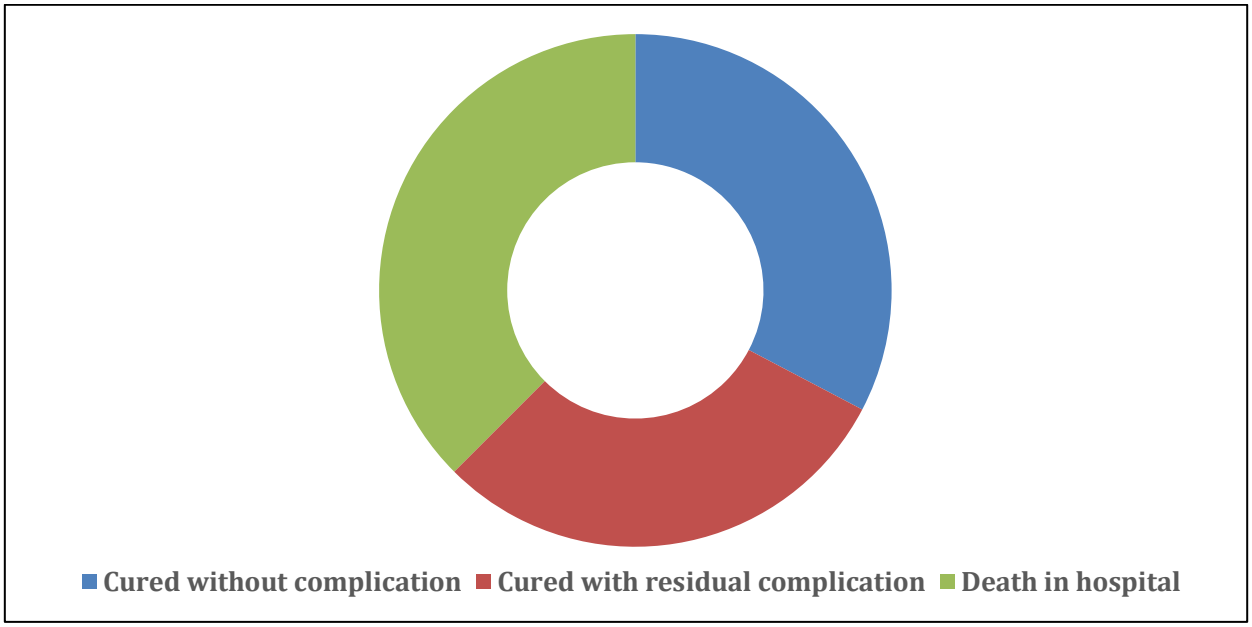


Fig. 3: Final outcome at 30-day monitoring

DISCUSSION

This prospective cohort showed a substantial burden of severe CAP in a tertiary care population. Mortality was strongly associated with older age, altered mentation, haemodynamic instability, tachypnoea, hypoxaemia, inflammatory and organ dysfunction markers, and greater radiological extent. Both CURB-65 and SMART-COP separated survivors from non survivors, although the pattern of separation was especially marked across the SMART-COP risk categories.

The study population had a median age of 51.5 years with modest male predominance. Non survivors were significantly older than survivors. Mehmood et al. reported a mean age of approximately 60 years in a more severe hospital based cohort, while Huang et al. demonstrated progressively worse outcomes with higher severity among elderly inpatients [7,8]. The direction of association in the present study is therefore consistent with prior evidence that age and reduced physiological reserve contribute to poor CAP outcome.

The bedside examination provided important prognostic information. Altered consciousness and disorientation clustered in the mortality group, and bilateral respiratory findings were much more common among non survivors. Confusion is a component of both CURB-65 and SMART-COP and reflects systemic illness, hypoxaemia and impaired cerebral function. Indian and international evaluations of severity scoring have similarly shown that structured bedside assessment is useful for identifying patients at risk of intensive care needs and death [9,10].

Physiological variables showed some of the strongest associations with mortality. Non survivors had a median oxygen saturation of 84% compared with 94% among survivors, together with hypotension, tachycardia and tachypnoea. These findings are clinically coherent with severe pneumonia complicated by respiratory failure and circulatory compromise. Studies from Indian hospital settings have also shown progressive worsening of ICU requirements and mortality with increasing severity scores [11,12].

CURB-65 remained clinically useful in the present cohort. The median score was 0 among survivors and 2 among non survivors, and mortality increased across the observed score levels. Lim et al. developed CURB-65 as a simple tool based on readily available variables [5]. Madhu et al. found CURB-65 to be relatively specific for identifying high risk patients, although more complex tools may have greater sensitivity for ICU admission [13]. The main advantage of CURB-65 in routine practice remains its speed and simplicity.

SMART-COP produced a wider separation of outcome groups. The median score was 2 among survivors and 6 among non survivors, and no deaths were reported in the low or moderate risk categories. SMART-COP was designed specifically to detect the need for intensive respiratory or vasopressor support [6]. A systematic review by Memon et al. reported high pooled sensitivity for intensive respiratory or vasopressor support, and more recent comparative work by Reddy et al. found greater sensitivity of SMART-COP than CURB-65 for vasopressor requirement and mechanical ventilation [14,15]. The present pattern is consistent with the physiological design of SMART-COP because hypoxaemia, acidosis, low blood pressure, low albumin, tachycardia, confusion and multilobar involvement were prominent among non survivors.

The observed mortality of 37.5% was higher than the 15.2% reported by Tuta-Quintero et al. in a large multicentre CAP cohort and higher than several Indian hospital series [16]. This likely reflects differences in case mix and referral severity. In the present study, non survivors had severe hypoxaemia, shock physiology and extensive radiological disease at admission. Chauhan et al. also showed that mortality was concentrated among ICU level patients in a tertiary care cohort [17].

Laboratory findings further supported the severity pattern. Higher leukocyte count and urea, thrombocytopenia, hypoalbuminaemia, acidosis and hypoxaemia were associated with mortality. SMART-COP incorporates albumin and arterial pH, which may partly explain why it separated the highest risk patients clearly in this dataset. Nevertheless, severity scores should complement rather than replace clinical judgement. Iftikhar and Waagsbø reported only moderate discrimination of several validated scoring systems and emphasized their role as aids to structured decision making [18].

A key limitation in direct comparison of the two scores is that the dissertation did not report receiver operating characteristic curves, area under the curve, sensitivity, specificity or an optimal threshold for the present dataset. Therefore, the current results demonstrate association and risk separation rather than statistically proven superiority in predictive accuracy. Meta analytic comparisons of PSI and CURB-65 likewise show that apparent performance depends on the selected endpoint and threshold [19].

The single centre design and tertiary care case mix limit generalisability. Some variables had little variation, and parts of the respiratory examination and radiological description were recorded as free text. Important potential confounders, including prior antibiotic exposure, time from symptom onset to hospital presentation and detailed comorbidity burden, were not uniformly captured. A larger multicentre study with prespecified receiver operating characteristic analysis and direct assessment of intensive respiratory or vasopressor support would provide a stronger comparison of the two scores.

CONCLUSION

Both CURB-65 and SMART-COP were strongly associated with mortality in adults with community acquired pneumonia in this tertiary care cohort. CURB-65 provided practical bedside risk stratification using a small number of readily available variables. SMART-COP showed clearer separation of the highest risk patients, consistent with its inclusion of oxygenation, arterial pH, blood pressure, albumin, tachycardia, confusion and multilobar disease. Early triage should therefore integrate structured severity scoring with direct assessment of oxygenation, haemodynamic stability, mental status and radiological extent. Because formal discrimination statistics were not

reported, further multicentre validation is required before claiming that one score has superior predictive accuracy.

AUTHOR CONTRIBUTIONS

DNK contributed to study conception, study design, data collection, data analysis, interpretation of results and preparation of the manuscript. HHS contributed to study design, methodology, interpretation of results and critical revision of the manuscript. PPF, HMJ, BHP and HAN contributed to literature review, interpretation of findings and critical review of the manuscript. All authors read and approved the final manuscript.

ACKNOWLEDGEMENT

The authors acknowledge the Department of General Medicine, Surat Municipal Institute of Medical Education and Research, Surat, and all study participants for their support and participation.

CONFLICT OF INTERESTS

The authors declare that there are no conflicts of interest.

FUNDING SOURCE

No external funding was received for this study.

REFERENCES

1. GBD 2019 Lower Respiratory Infections Collaborators. Global, regional, and national burden of lower respiratory infections and risk factors, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet Infect Dis. 2022;22(11):1626-1647. doi:10.1016/S1473-3099(22)00510-2.
2. Metlay JP, Waterer GW, Long AC, Anzueto A, Brozek J, Crothers K, et al. Diagnosis and treatment of adults with community-acquired pneumonia: an official clinical practice guideline of the American Thoracic Society and Infectious Diseases Society of America. Am J Respir Crit Care Med. 2019;200(7):e45-e67. doi:10.1164/rccm.201908-1581ST.
3. Lim WS, Baudouin SV, George RC, Hill AT, Jamieson C, Le Jeune I, et al. BTS guidelines for the management of community acquired pneumonia in adults: update 2009. Thorax. 2009;64(Suppl 3):iii1-iii55. doi:10.1136/thx.2009.121434.
4. Fine MJ, Auble TE, Yealy DM, Hanusa BH, Weissfeld LA, Singer DE, et al. A prediction rule to identify low-risk patients with community-acquired pneumonia. N Engl J Med. 1997;336(4):243-250. doi:10.1056/NEJM199701233360402.
5. Lim WS, van der Eerden MM, Laing R, Boersma WG, Karalus N, Town GI, et al. Defining community acquired pneumonia severity on presentation to hospital: an international derivation and validation study. Thorax. 2003;58(5):377-382. doi:10.1136/thorax.58.5.377.
6. Charles PGP, Wolfe R, Whitby M, Fine MJ, Fuller AJ, Stirling R, et al. SMART-COP: a tool for predicting the need for intensive respiratory or vasopressor support in community-acquired pneumonia. Clin Infect Dis. 2008;47(3):375-384. doi:10.1086/589754.
7. Mehmood A, Anwar A, Liaquat H, Shahid Z, Khan S, Lail H, et al. Comparative evaluation of severity scoring systems in community acquired pneumonia. Pak J Chest Med. 2025;31(1):59-66.
8. Huang L, Sim B, Patel K, Chan K, Louie A, et al. Performance of various pneumonia severity models for adverse outcomes among elderly inpatients with community-acquired pneumonia: a multicentre cohort study. Clin Microbiol Infect. 2024;30:1426-1432. doi:10.1016/j.cmi.2024.07.004.
9. Babu A, Jose N, Jose J. A prospective observational study to evaluate the severity assessment scores in community-acquired pneumonia for adult patients. Indian J Respir Care. 2017;6:820-823. doi:10.4103/ijrc.ijrc_8_17.
10. Alavi Moghaddam M, Bakhshi H, Rezaei B, Khashayar P. Comparison of pneumonia severity index and CURB-65 criteria for predicting the outcome of patients with community acquired pneumonia admitted to an emergency department. Braz J Infect Dis. 2013;17(2):179-184. doi:10.1016/j.bjid.2012.10.006.
11. Patil P, Tyagi A, Waghmare M, Srivastava AK, Waran M. A comparative study of PSI and CURB-65 scoring systems in predicting ICU admissions and mortality in cases of community-acquired pneumonia. Int J Med Res Rev. 2020;8(3):240-246. doi:10.17511/ijmrr.2020.i03.04.
12. Ravindranath M, Raju CH. Validity of pneumonia severity index/pneumonia outcome research trial and CURB-65 severity scoring systems in community acquired pneumonia in Indian setting. Int J Adv Med. 2016;3(2):338-344.
13. Madhu S, Mohan A, Sharma R. Severity assessment of community acquired pneumonia in adults: comparison of CURB-65, PSI and IDSA/ATS criteria. Int J Adv Med. 2017;4(4):1084-1088. doi:10.18203/2349-3933.ijam20173196.

14. Memon RA, Rashid MA, Avva S, Das S, Ghazi H, Priyadharshini P, et al. The use of the SMART-COP score in predicting severity outcomes among patients with community-acquired pneumonia: a meta-analysis. Cureus. 2022;14(7):e27248. doi:10.7759/cureus.27248.
15. Reddy KK, Prakash SS, Chandrasekaran ND, Kumar JS, Nalabothula R, Sandeep ML. Comparison of scoring systems (SMART-COP vs CURB-65) in predicting the need for vasopressor and mechanical ventilation support in patients with community-acquired pneumonia. Niger Postgrad Med J. 2026;33:97-102. doi:10.4103/npmj.npmj_401_25.
16. Tuta-Quintero E, Bastidas-Goyes AR, Guerrón-Gómez G, Martínez MC, Torres D, Schloss C, et al. Comparison of performances between risk scores for predicting mortality at 30 days in patients with community acquired pneumonia. BMC Infect Dis. 2024;24:912. doi:10.1186/s12879-024-09792-1.
17. Chauhan AP, Majmundar A, Lakhani S, Lakhani J. A comparative study between CURB-65 and PSI/PORT score as predictors for ICU admission and mortality in community acquired pneumonia patients presenting to a tertiary care hospital. Indian J Clin Anaesth. 2024;11(2):181-187. doi:10.18231/j.ijca.2024.036.
18. Iftikhar H, Waagsbø B. Assessment of disease severity in hospitalized community-acquired pneumonia by the use of validated scoring systems. BMC Pulm Med. 2025;25:100. doi:10.1186/s12890-025-03550-y.
19. Zaki HA, Alkahlout BH, Shaban E, Mohamed EH, Basharat K, Elsayed WA, et al. The battle of the pneumonia predictors: a comprehensive meta-analysis comparing the pneumonia severity index (PSI) and the CURB-65 score in predicting mortality and the need for ICU support. Cureus. 2023;15(7):e42672. doi:10.7759/cureus.42672.