International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Scoring Toward Stewardship: APACHE and CURB-65 in De-escalating Antibiotics for Respiratory Tract Infections

Angelin Ann Anil[1], Sharon Wilson[2], Tintu Thomas[3], Ancy Anil[4], Abhilash Kumar B[5]

[1,2,3,4]Pharm D, Nazareth College of Pharmacy, Thiruvalla, Kerala, India
[5]Assistant Professor, Nazareth College of Pharmacy, Thiruvalla, Kerala, India

ABSTRACT

Background: Antibiotic de-escalation is an important part of antimicrobial stewardship programmes (ASPs), whereby the provision of effective initial antibiotic treatment is achieved while avoiding unnecessary antibiotic use that would promote the development of resistance. In this study, the average time to first de-escalate antibiotics in respiratory tract infections was assessed based on APACHE-II score, CURB-65 score. The APACHE (Acute Physiology and Chronic Health Evaluation) and CURB-65 (Confusion, Urea, Respiratory rate, Blood pressure, Age ≥65) scoring systems are vital tools in assessing the severity of Respiratory Tract Infections (RTI's), particularly in hospitalized patients. By stratifying patients based on disease severity, these scores help clinicians make informed decisions about initiating, continuing, or de-escalating antibiotic therapy and promote antibiotic stewardship.

Objective: To assess the de-escalation of antibiotics based on severity of infection using the APACHE II and CURB-65 scoring methods.

Materials and Methods: A retrospective cohort study conducted at Believers Church Medical College Hospital, Thiruvalla. Our study population includes 571 patients who were admitted to the respiratory ward. The data was taken through the IT department of the hospital. The study was conducted for a period of six months (November 2023 – April 2024). All patients above 18 years were included in the study. The data of patients who met inclusion criteria was collected and entered into the Excel sheet through google form. KM Curves were used to estimate the median survival time of de-escalation of antibiotics stratified for the risk factors.

Results: The percentage of patients with an APACHE II score of less than 13 increased from **47.29%** at admission to **81.96%** at time of de-escalation. Conversely, the percentage of patients with an APACHE II score of 13 or more decreased from **52.71%** at admission to **18.04%** at time of de-escalation. Out of the 571 patients, 274(**47.99%**) had a CURB-65 score of 0, 210(**36.78%**) with score of 1,51(**8.93%**) with score of 2, 12(**2.10%**) with a score of 3, 15(**2.63%**) with a score of 4 and 9(**1.58%**) with a score of 5.

Conclusion: The results suggests that the treatments and care provided in the wards were effective in improving the patient's conditions, as reflected by the decrease in APACHE II and CURB-65 score from admission to time of de-escalation.

KEYWORDS: APACHE II, CURB-65, Antibiotics, De-escalation, Respiratory Tract Infection

INTRODUCTION

Respiratory tract infections are a common cause of illness, that can lead to morbidity and mortality and it is vital to provide appropriate antibiotic therapy for the best possible outcomes for patients. However, using antibiotics improperly can lead to antimicrobial resistance. To address this issue, it's important to employ strategies for de-escalating antibiotic therapy in respiratory tract infections. These approaches ought to encompass accurate pathogen identification, evaluation of antibiotic susceptibility patterns, and evaluation of the patient's response to initial therapy. [1] The population of India is highly resistant to drugs and is among the top consumers of antibiotics with large multi-drug resistance. AMR has developed due to several reasons which includes, inadequate control over the sale of antibiotics, a preference for the use of broad-spectrum antibiotics, the widespread use of fixed drug combinations, and a general lack of community awareness. India has undertaken programs to enhance antimicrobial stewardship over the past ten years. [2]

The CURB-65 score is a clinical model used to predict the severity of pneumonia and mortality. It was developed in 2002 at the University of Nottingham by Dr W.S. Lim et al. and is based on 5 elements: Confusion (mental test score ≤8 new disorientation in person, place or time), BUN >20mg/dL, Respiratory rate ≥30 breaths/min, Blood pressure (systolic <90mmHg, or diastolic <60mmHg), Age ≥65 years. [3]

The CURB-65 score can be used to allocate patients into five subgroups based on their risk stratification:

Table No. 1

CURB-65 SCORE	RISK STRATIFICATION
0	Low mortality risk and outpatient treatment
1	Moderate risk and consider hospitalization
2	High risk and recommended hospitalization
3 and higher	Very high risk, severe pneumonia, and consider admittance to ICU

The APACHE II score is a broad indicator of the severity of an illness that takes into account age, prior medical history, and current physiological data. Knaus and colleagues first created the Acute Physiology and Chronic Health Evaluation (APACHE) score in 1981 through a nominal group procedure. The initial APACHE score consisted of two parts: a preadmission health status assessment to ascertain the patient's chronic health state and a physiology score to gauge the degree of acute sickness. In 1985, Knaus and colleagues made changes to the original APACHE model to create APACHE II. They simplified the model by reducing the number of physiological measurements from 34 to 12. [4] The 12 variables are Temperature, Mean Arterial Pressure, Heart rate, Respiratory rate, Oxygenation (PaO2/FiO2 or A-a gradient), Arterial pH, Serum Sodium, Potassium, Creatinine, Hematocrit, White Blood Cell Count, Glasgow Coma Scale (GCS).

Age is factored into the following scores:

Table No.2

Age	Score
< 45 years	0
45-54 years	2
55-64 years	3

65-74 years	5
≥ 75 years	6

Each proposed revision was carefully compared to the original APACHE to ensure accuracy. Age and chronic health status were directly included in the model, with their impacts weighted accordingly. The recorded value is based on the measurement taken within the first 24 hours of a patient's admission. The score ranges from 0 to 71, with a higher score corresponding to a higher risk of hospital death. Higher scores indicate a greater departure from normal for each characteristic, which is weighted from 0 to 4. A score of 25 indicates a 50% chance of death, whereas a score of more than 35 indicates an 80% chance of death. APACHE II severity score is still the most widely used international severity scoring system in the world, with good calibration and discriminatory value across a variety of illness processes. [5]

METHODOLOGY

A Retrospective Cohort Study was conducted in Believers Church Medical College Hospital, Thiruvalla, Kerala, India, for a period of six months (November 2023-April 2024). A purposive sample was taken and the study population included 571 patients. The study was approved by the Institutional Review Board of Believers Church Medical College Hospital.

Inclusion criteria

Patient's above 18 years of age and those who were admitted to the medical ward were included in the study

Exclusion criteria

Pregnant and lactating women and those who were admitted in the ICU were excluded from the study.

Data collection method

The data were taken from the IT department of Believers Church Medical College Hospital, Thiruvalla. The data of patients who met inclusion criteria was collected and entered into the Excel sheet through google form. The data collected includes demographic data such as name, age, sex, date of admission, date of discharge, medical history of the patient, lab investigations required to calculate the APACHE II score, and CURB-65 score. Culture sensitivity reports were taken from the Microbiology Lab Registry. The drug details, includes the name of the drug, dosage, duration of therapy, route of drug administration, and time of de-escalation, were recorded.

Statistical analysis

The analysis was performed after entering the data in Microsoft excel-2013 version, then the results obtained were analysed and represented with graphs and tabulations.KM Curves were used to estimate median survival time of each type of de-escalation stratified for the various risk factors.

RESULTS

APACHE II SCORE

Table No. 3: Distribution of APACHE II score at admission

SL.NO	APACHE SCORE	FREQUENCY	PERCENTAGE
1.	<13	270	47.29%
2.	>=13	301	52.71%
	TOTAL	**571**	**100%**

Table No. 4: Distribution of APACHE II score at the time of de-escalation

SL.NO	APACHE SCORE	FREQUENCY	PERCENTAGE
1.	<13	468	**81.96%**
2.	>=13	103	**18.04%**
	TOTAL	**571**	**100%**

Figure No. 1: Distribution of APACHE II score at admission and at the time of de-escalation

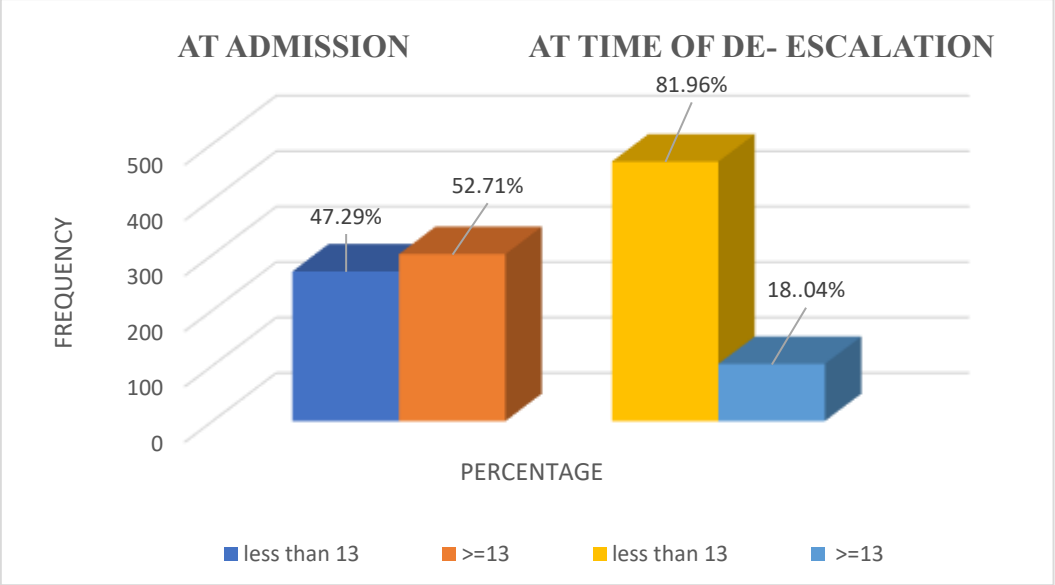
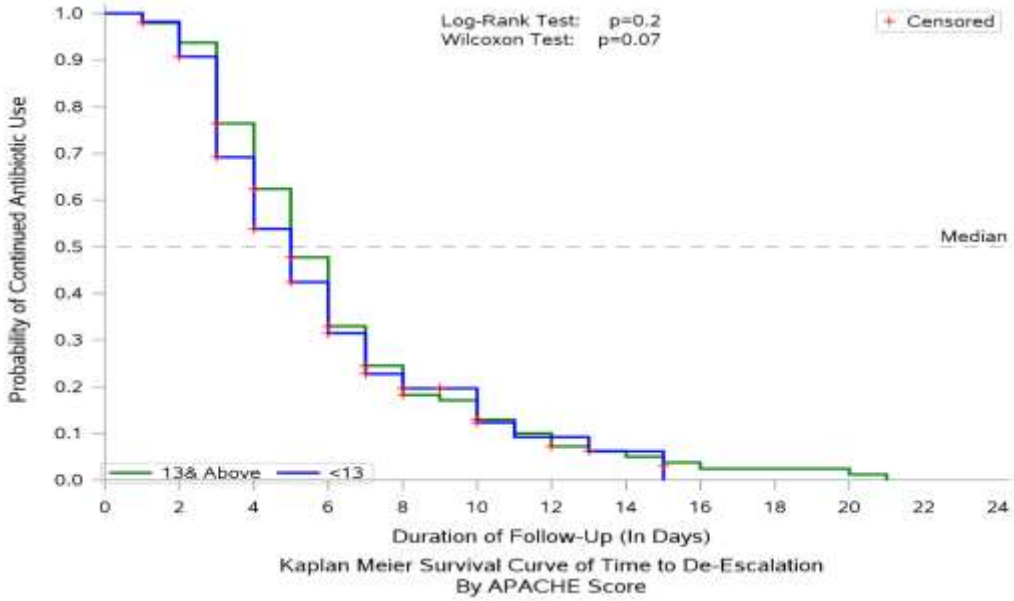


Table No. 4: The table shows the APACHE II score of the patients at the time of admission. From the 571 total cases, 270 cases (or 47.29%) had an APACHE II score of less than 13, and 301 cases (or 52.71%) had an APACHE II score of 13 or more.

Table No. 5: The table shows the Apache II score of the patients at the time of de-escalation. From the 571 total study population, 468 cases (or 81.96%) had an APACHE II score of less than 13. 103 cases (or 18.04%) had an APACHE II score of 13 or more at time of de-escalation.

When we compare tables no. 4 and 5 and figure no.1, it indicates that the condition of many patients improved during their stay in the wards. The percentage of patients with an APACHE II score of less than 13 increased from **47.29%** at admission to **81.96%** at time of de-escalation. Conversely, the percentage of patients with an APACHE II score of 13 or more decreased from **52.71%** at admission to **18.04%** at time of de-escalation. This suggests that the treatments and care provided in the wards were effective in improving the patients' conditions, as reflected by the decrease in APACHE II score from admission to time of de-escalation.

Figure No. 2: Distribution of KM – survival curve of time to de-escalation by APACHE II score



The graph is a Kaplan-Meier survival curve. It specifically examines the relationship between APACHE II scores and the duration it takes to de-escalate antibiotics. The Y-axis represents the probability of continued antibiotic use, ranging from 0.0 to 1.0. The X-axis represents the duration of follow-up (in days), ranging from 0 to approximately 24 days. Two groups are compared: "the 13 and above" APACHE II score (represented by the green step-line) and the "<13" APACHE II score (represented by the blue step-line).

Interpretation of the graph: Patients with higher APACHE II scores (>13) have a higher probability of continued antibiotic use over time. In contrast, patients with lower APACHE II scores (<13) show a lower probability of continued antibiotic use. Although the statistical tests do not reach conventional significance levels, there is still a trend suggesting that higher APACHE II scores may be associated with longer antibiotic treatment. Estimating the approximate de-escalation time based on the Kaplan-Meier Survival Curve for both groups: for group 13 and above (green line), the median time to de-escalation for this group is approximately 18 days (as indicated by the green line intersecting the red curve), and for group <13 (blue line), the median time to de-escalation for this group is approximately 12 days (as indicated by the green line intersecting the blue curve).

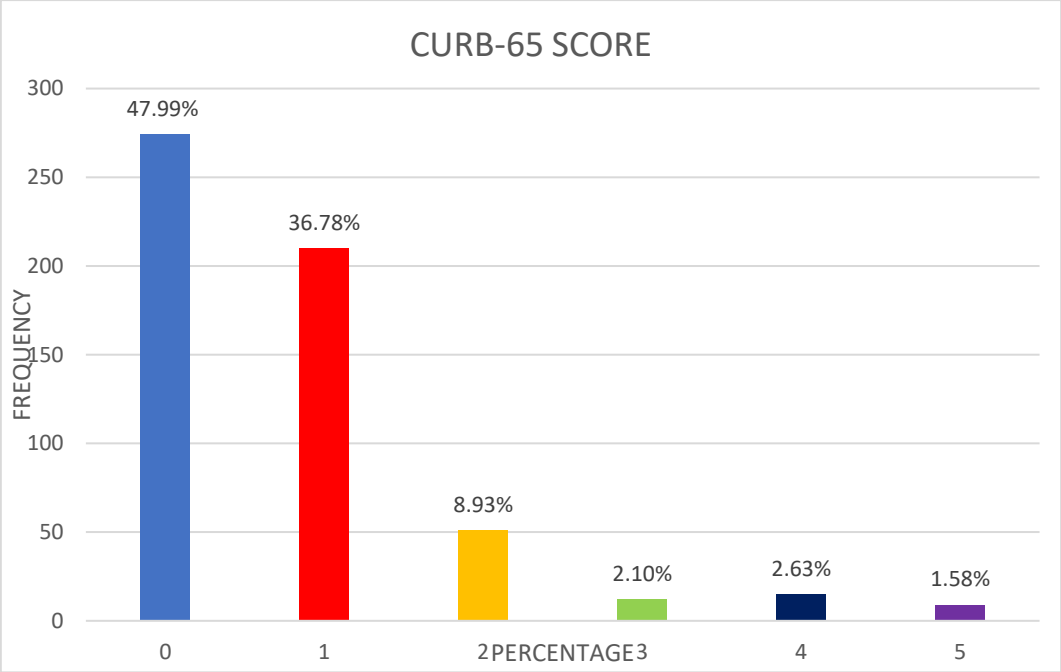
CURB – 65 SCORE

Table No.5: Distribution of CURB-65 score

CURB-65 SCORE	FREQUENCY	PERCENTAGE
0	274	47.99%
1	210	36.78%
2	51	8.93%
3	12	2.10%
4	15	2.63%
5	9	1.58%

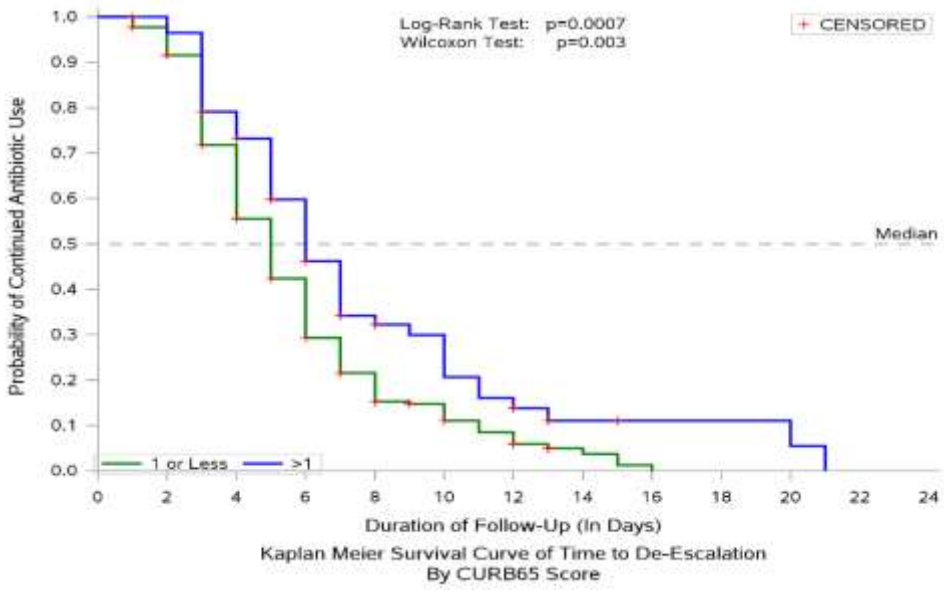
TOTAL	**571**	**100%**

Figure No. 3: Distribution of CURB-65 score



The above table and figure show the frequency distribution of CURB-65 score. Out of 571 patients it has been found that 274 people had CURB-65 score of 0 (47.99%), 210 people with a CURB-65 score of 1(36.78%), 51 people with a CURB-65 score of 2 (8.93%), 12 people with a CURB-65 score of 3 (2.10%), 15 people with a CURB-65 score of 4 (2.63%), 9 people with a CURB-65 score of 5. From the study it has been found that as most of the people had a CURB 65score of 0 and 1.

Figure No. 4: Distribution of KM – survival curve of time to de-escalation by CURB-65 score



The graph shows two survival curves, each representing a different group of patients. The x-axis represents the duration of follow-up (in days), and the y-axis represents the probability of continued antibiotic use. The green curve corresponds to patients with a CURB-65 score of 1 or less. The blue curve corresponds to patients with a CURB-65 score greater than 1. Red plus symbols indicate de-escalation did not occur during the follow-up period for those patients. The green curve (CURB-65 score ≤ 1) starts higher, indicating a higher initial probability of continued antibiotic use. The blue curve (CURB-65 score > 1) starts lower, suggesting a lower initial probability of continued antibiotic use. As time progresses, the green curve declines more rapidly, indicating that patients with a lower CURB-65 score are more likely to de-escalate antibiotic therapy sooner. The blue curve declines more gradually, suggesting that patients with a higher CURB-65 score continue antibiotic use for a longer duration. The median (where the dashed horizontal line intersects the green curve) represents the time at which half of the patients in the green group had de-escalated antibiotic use. P-values indicate statistical significance in the differences between the two groups. In other words, the probability of these differences occurring by chance is very low.

DISCUSSION

In our study, the APACHE II score of patients was calculated at the time of admission and discharge and found that patients at admission with an APACHE II score above 13 comprised 52.71%, which decreased to 18.04% before discharge. This shows the recovery of the patients before discharge. However, no specific studies were conducted on the APACHE II score at the ward level; the studies done were in critical care units. **A. Aggarwal** et.al, found APACHE II performed well in a respiratory intensive care unit in north India.[6] However, these findings were in contrast to the study conducted by **Gupta et.al,** on the performance evaluation of the APACHE II score for an Indian patient with respiratory problems. The study found that the APACHE II score had poor calibration and discrimination ability in predicting mortality in critically ill Indian patients with respiratory problems and also suggested that the model may be more useful for Indian patients by lowering the cut-off value in the allotment of age points and by awarding the weightage to factors like co-existing immunocompromised states. [7]

From the study it has been found that there is CURB-65 score can be used for de-escalation of antibiotics. This has also been established in already published studies that CURB-65 can be used to narrow the antibiotics. This study was in similar to the study conducted **by James D Chalmers et.al**, Safety and efficacy of CURB-65 score guided antibiotic therapy in community-acquired pneumonia. From this study it was found that CURB-65 score guided antibiotic therapy was associated with a significant decrease in broad spectrum antibiotic use. [8]

CONCLUSION

Efforts should also be aimed at optimizing empirical therapy, which may reduce the need for ADE later on; this is where rapid diagnostic techniques may have an important role like CURB-65 score, APACHE II score. We present an overview of current evidence from our retrospective cohort study on CURB-65 based diagnosis of RTIs.The findings of our study showed that de-escalation was associated with better patient outcomes in patients admitted due to RTIs. Our results also confirm that ADE is safe and efficient in reducing the overall antimicrobial exposure and promote antimicrobial stewardship program, especially in patients with respiratory tract infection.

REFERENCES

1. Murray CJ, Ikuta KS, Sharara F, Swetschinski L, Aguilar GR, Gray A, Han C, Bisignano C, Rao P, Wool E, Johnson SC. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. The lancet. 2022 Feb 12;399(10325):629-55.
2. Das S. Haque I, Gaur A, Suhail Mustafa M. de-escalation pattern of antibiotics in the medical intensive care unit of a tertiary care hospital in north India. World Journal of Pharmacy and Pharmaceutical Sciences, 2020 Jan 9:1451-1460
3. Carlos P, Gomes R, Coelho J, Chaves C, Tuna C, Louro M. CURB-65 and Long-Term Mortality of Community-Acquired Pneumonia: A Retrospective Study on Hospitalized Patients. Cureus. 2023 Mar 12;15(3).
4. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. Critical care medicine. 1985 Oct 1;13(10):818-29.
5. Wagner DP, Draper EA. Acute physiology and chronic health evaluation (APACHE II) and Medicare reimbursement. Health care financing review. 1984 Nov;1984(Suppl):91.
6. Aggarwal AN, Sarkar P, Gupta D, Jindal SK. Performance of standard severity scoring systems for outcome prediction in patients admitted to a respiratory intensive care unit in North India. Respirology. 2006 Mar;11(2):196-204.
7. Gupta R, Arora VK. Performance evaluation of APACHE II score for an Indian patient with respiratory problems. Indian Journal of Medical Research. 2004 Jun 1; 119:273-82.
8. Chalmers JD, Singanayagam A, Akram AR, Choudhury G, Mandal P, Hill AT. Safety and efficacy of CURB65-guided antibiotic therapy in community-acquired pneumonia. Journal of Antimicrobial Chemotherapy. 2011 Feb 1;66(2):416-23.