NEWS2 Versus PSI in CAP

Neelam Kumari

Jinnah Post Graduate Medical Centre

Nausheen Saifullah

Jinnah Post Graduate Medical Centre

Naseem Ahmed

Jinnah Post Graduate Medical Centre

Saira Jafri (✉ meetsaira@gmail.com)

Jinnah Post Graduate Medical Centre

Aziz Barry

Jinnah Post Graduate Medical Centre

Nadia Jawad

Jinnah Post Graduate Medical Centre

Research Article

Keywords: Pneumonia, Community-Acquired Infections, Pulmonary Inflammation, Death

Posted Date: August 24th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-314691/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

NEWS2 versus PSI in CAP

To compare NEWS2 with PSI to predict in-hospital mortality in patients with community acquired pneumonia

1. *Dr. Neelam Kumari*

Address: Flat C-402, Al-Habib Pride, CL 5/8, Civil Lines, Cantt, Karachi

2. *Dr. Nausheen Saifullah*

Address: D-199, Block 4, Federal B Area, Karachi

3. *Dr. Naseem Ahmed*

Address: Flat no. B4, First Floor, Category 4, Doctors' Colony, JPMC, Karachi

4. ***Dr. Saira Jafri****

Address: 1101, Hafsa Square Residence, Main Shaheed e Millat Road, PECHS Block 3, Karachi. 75400

Email: meetsaira@gmail.com

Phone: +92333-2110981

5. *Dr. Aziz Barry*

Address: 30A/3 Main Khayaban e Jami, Opposite Erum Garden, Phase 4, DHA, Karachi.

6. *Dr. Nadia Jawad*

Address: 51/2, Lane 18, Khayaban e Badban, Phase 7, DHA, Karachi.

All authors are affiliated with: **Jinnah Postgraduate Medical Centre, Karachi, Pakistan**

*Corresponding Author

NEWS2 versus PSI in CAP

ABSTRACT:

BACKGROUND: In the UK, National Early Warning Score (NEWS2) has been in frequent use to precisely categorize patients according to severity and as an aid in deciding the level of management. NEWS2 is an excellent tool that does not need any laboratory investigation to mark. With Pneumonia Severity Index (PSI), however, many variables are taken into account i.e. clinical, laboratory and imaging to score the patients into classes of severity. Our aim is to compare NEWS2 with PSI to foresee in-hospital mortality in patients with community acquired pneumonia (CAP).

METHODS: A cross-sectional analytical study was conducted on a sample of 116 Pakistanis presenting with CAP. We performed statistical analyses on SPSS version 22.0 and observed frequencies of various categorized variables. ROC curve for estimating AUC and sensitivity analyses were performed to evaluate predictive validity of each severity score in relation to in-hospital outcome.

RESULTS: There were 45 (38.8%) mortalities during the hospital stay. Sensitivity of NEWS2 in terms of mortality prediction was 97.8% but specificity was only 15.5% whereas PSI showed worse sensitivity (68.9%) but better specificity (50.7%).

CONCLUSION: NEWS2 is much more sensitive than specific for prediction of mortality among CAP patients as compared to PSI.

KEYWORDS: Pneumonia, Community-Acquired Infections, Pulmonary Inflammation, Death

INTRODUCTION:

CAP is the acute lung parenchymal infection that is acquired outside of a hospital setting¹. It is one of the most common causes of morbidity, hospitalizations and deaths worldwide². CAP is the most frequent infectious cause of death in the US and third most common cause of death in Japan^{2,3}. Unfortunately however in the low income countries like Pakistan, pneumonia is the top most killer⁴.

The economic and clinical burden of this illness on the healthcare system is worrisome not only in resource-poor settings in developing countries but also in the developed parts of the world^{5,6,7}. The rates of hospitalization of patients with CAP are considerably variable, one contributory factor being physicians' judgement in assessing the severity of illness at presentation⁸. In a bid to avoid such discrepancies in the management of CAP, a large amount of work has been registered in medical literature in developing a scoring system efficient enough for guiding the physicians internationally to assess the gravity of the disease, the need for hospitalization as well as a timely escalation of treatment.

An ideal initial scoring system should be simple, easy to use, not requiring much of the laboratory work-up and imaging techniques. It must not only provide us with sufficient competency to not miss any critical case but also be applicable at the same time in any setting, including the underprivileged. Many scoring systems have been devised and studied on the populations, all with many benefits and shortcomings. Despite this, clinical judgement still plays a greater role in the management of CAP and scores "alone" cannot be relied upon.

Although PSI, which was validated in 1991 in pneumonia patient outcomes research team (PORT) cohort study, has been deemed superior to CURB65 in recent ATS/IDSA guidelines, clinical judgement has still been called compulsory with it⁹. With PSI, clinical, laboratory and imaging parameters are taken into account to stratify the patients into classes of severity. Scoring patients based on the PSI thus requires time and resources.

Developed first in the late 90's, introduced in 2012, repeatedly modified as well as validated later, one scoring system that has gained much attention in recent years is NEWS2 that uses vital signs, consciousness level, oxygen saturation and need for supplemental oxygen therapy in the acutely ill^{10,11,12}. NEWS2 is based on the principle that hemodynamic instability heralds the clinical deterioration. It also ensures the judicious use of oxygen in patients with chronic type 2 respiratory failure usually found in the COPD patients during acute exacerbations¹³. NEWS2 is not specifically designed for CAP but for identifying any critical illness. Simultaneously it has been observed that CAP is associated with high short term mortality¹⁴.

The objective of this study is to compare the two scores (PSI and NEWS2) to predict the in-hospital mortality of patients with CAP.

METHODS:

First an ethical approval (No. F.2-81/2020-GENL/42820/JPMC) was taken from Institutional Review Board Committee of Jinnah Postgraduate Medical Centre (JPMC), Karachi. We conducted a cross-sectional analytical study prospectively on a sample of 116 Pakistani, consenting adults presenting with clinico-radiological diagnosis of CAP over a 6 months' period at Pulmonology ward, JPMC. Subjects with diagnoses of hospital acquired pneumonia (HAP), aspiration pneumonia, pulmonary tuberculosis, pulmonary edema, and pulmonary embolism were excluded. Proformas were filled with initial presentation data and were completed as an outcome was achieved. We performed statistical analyses on SPSS version 22.0. ROC curve (for estimating AUC) with sensitivity analyses were utilized to evaluate predictive validity of each score in relation to in-hospital outcome. All numeric variables including age, NEWS2 and PSI scorings of severity of CAP were explored for assessing normality by Kolmogorov-Smirnov test. The numeric variables were presented as median, were compared by employing non-parametric Wilcoxon Mann Whitney test and later were expressed as frequencies and percentages. Post-stratification, these variables were compared by employing McNemar test to evaluate cross validation of NEWS2 scores with PSI. Sensitivity analyses of severity scores were performed by taking in-hospital mortality as an outcome measure. All categorical variables including in-hospital outcome, gender and clinical factors of severity of disease were presented as frequencies and percentages. Logistic regression analysis was performed to evaluate significance of predictive factors leading towards in-hospital mortality. P-value ≤ 0.05 was considered statistically significant.

RESULTS:

Of 116 subjects, 75 (64.7%) were males and 45 (35.3%) females. Mean age was 46.9 ± 20.5 years. A total of 45 (38.8%) mortalities took place during the hospital stay. On evaluation of NEWS2, 104 (89.7%) patients were identified as being at high risk for mortality while 12 (10.3%) at a low risk, the cut offs scores being ≥ 5 and < 5 respectively. PSI on the other hand, spotted 66 (56.9%) high risk and 50 (43.1%) low risk patients with cut-off being ≥ 91 and < 91 respectively.

Sensitivity of NEWS2 in anticipating mortality in CAP patients was 97.8% as 44 out of 45 cases who expired were stratified as high risk NEWS2 (score $\geq$ 5). However, specificity of NEWS2 was poor i.e. 15.5% because out of the 71 who survived, merely 11 (15.5%) were kept as low risk at presentation. Therefore, NEWS2 does not prove to be an ideal tool at all in identifying true negatives. Comparatively the sensitivity of PSI in mortality prediction was reasonably good i.e. 68.9% while specificity was 50.7% (Table-1). There was noteworthy concordance between the predictive risk scorings of NEWS2 and PSI upon cross-validation (Table-2).

Predictive validity of NEWS2 in terms of ROC [AUC: 0.725 (95% CI: 0.632-0.818), $p=0.000$] uncovered significant utility of the score in prediction of in-hospital mortality, quite comparable to that of PSI [AUC: 0.669 (95% CI: 0.568-0.769), $p=0.002$] (Figure-1).

Logistic regression analyses brought forth two predictors of severity that led to mortality i.e. stroke (OR=8.75, 95% CI: 0.99-77.5) and renal disease (OR=14.5, 95% CI: 1.67-125) (Table-3).

DISCUSSION:

A multicenter study done in emergency departments of different cities in Turkey compared various pneumonia severity scores, including PSI and NEWS and found out that NEWS performed better in predicting mortality in CAP as compared to PSI similar to our study's finding, however the highest specificity for mortality in that research was with NEWS-L (NEWS LACTATE)¹⁵. Another single-center study performed in China also evaluated a decent number of scoring systems keeping mortality as their primary outcome and ICU admissions and need for mechanical ventilation as their secondary outcomes. NEWS outperformed all of the scoring systems, including PSI except for MEDS (Mortality in Emergency Department Sepsis) and further addition of lactate did not improve the predicting ability of NEWS¹⁶.

Another interesting multicenter prospective cohort study of 6 years compared NEWS, PSI and CURB65 and observed that NEWS was a better predictor of adverse effects but PSI and CURB65 outperformed NEWS when comparing the all-cause mortality prediction in 6 years of admission in the ED, one reason being that PSI and CURB65 take into consideration the comorbid conditions and age of the patient in contrast to NEWS which only sees the current status, but this helped in tracking young patients who were classified as low risk by PSI due to young age and less number of comorbid conditions but who were sick and required ICU admission¹⁴.

The reason we chose NEWS2 instead of NEWS for comparison was that it has been updated and is inclusive of the patients with hypercapnic respiratory failure as they require controlled oxygen therapy as compared to the normal population with previously healthy lungs¹⁷.

The strength of our work is that this is the first study in Pakistan comparing NEWS2 and PSI in predicting the mortality in hospitalized patients. Whereas the limitation being that we scored the patients at the time of admission only and did not use NEWS2 scores again after resuscitation or during treatment to predict change in the risk severity therefore we assume that the specificity could be better if NEWS2 was calculated at different intervals during the hospital stay because it is easy to use, cost effective and needs only bedside parameters. Majority of the studies including ours have seen the short-term mortality of patients with the scoring systems, it will be interesting to see how NEWS2 performs during out-patient follow ups of patients who survived.

CONCLUSION:

NEWS2 is an extremely sensitive tool for risk stratification in CAP patients in resource deprived setups therefore it must be utilized at the time of presentation even before further investigations are done.

DECLARATIONS:

i. Funding: N/A

ii. Conflicts of interest: All authors have no conflicts of interest or disclosures

iii. Ethics approval: Taken from JPMC Institutional Review Board Committee on 7th May 2020

iv. Consent to participate: An informed consent for participation was taken from either the patient themselves or the attendant, whichever was possible

v. Consent for publication: N/A

vi. Availability of data and material (data transparency): N/A

vii. Code availability (software application or custom code): N/A

viii. Authors' contributions

Neelam Kumari: Acquisition of data, drafting the work

Nausheen Saifullah: Final approval of the version to be published

Naseem Ahmed: Revising the work critically, supervision

Saira Jafri: The conception or design of the work, drafting, analysis, or interpretation of data

Aziz Barry: Acquisition of data

Nadia Jawad: Revising the manuscript critically for important intellectual content

REFERENCES:

1. Metlay JP, Waterer GW, Long AC, 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.
2. Konomura K, Nagai H, Akazawa M. Economic burden of community-acquired pneumonia among elderly patients: a Japanese perspective. Pneumonia. 2017 Dec;9(1):1-0.doi: 10.1186/s41479-017-0042-1.
3. Xu J, Murphy SL, Kochanek KD, Bastian B, Arias E. Deaths: final data for 2016. <https://stacks.cdc.gov/view/cdc/57989>

4. World Health Organization. The top 10 causes of death (Fact sheet updated January 2017).
<https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death>
5. Huang SS, Johnson KM, Ray GT, Wroe P, Lieu TA, Moore MR, Zell ER, Linder JA, Grijalva CG, Metlay JP, Finkelstein JA. Healthcare utilization and cost of pneumococcal disease in the United States. *Vaccine*. 2011 Apr 18;29(18):3398-412. doi:10.1016/j.vaccine.2011.02.088.
6. Reyes S, Martinez R, Valles JM, Cases E, Menendez R. Determinants of hospital costs in community-acquired pneumonia. *European Respiratory Journal*. 2008 May 1;31(5):1061-7. doi:10.1183/09031936.00083107.
7. Rozenbaum MH, Mangen MJ, Huijts SM, van der Werf TS, Postma MJ. Incidence, direct costs and duration of hospitalization of patients hospitalized with community acquired pneumonia: a nationwide retrospective claims database analysis. *Vaccine*. 2015 Jun 22;33(28):3193-9. doi:10.1016/j.vaccine.2015.05.001.
8. Fine MJ, Auble TE, Yealy DM, Hanusa BH, Weissfeld LA, Singer DE, Coley CM, Marrie TJ, Kapoor WN. A prediction rule to identify low-risk patients with community-acquired pneumonia. *New England journal of medicine*. 1997 Jan 23;336(4):243-50. doi:10.1056/NEJM199701233360402.
9. Metlay, J.P., Waterer, G.W., Long, A.C., Anzueto, A., Brozek, J., Crothers, K., Cooley, L.A., Dean, N.C., Fine, M.J., Flanders, S.A. and Griffin, M.R., 2019. 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. *American journal of respiratory and critical care medicine*, 200(7), pp.e45-e67.
<https://doi.org/10.1164/rccm.201908-1581ST>
10. Stenhouse C, Coates S, Tivey M, Allsop P, Parker T. Prospective evaluation of a modified Early Warning Score to aid earlier detection of patients developing critical illness on a general surgical ward. *British Journal of Anaesthesia*. 2000 May 1;84(5):663P.
<https://doi.org/10.1093/bja/84.5.663>
11. Fu LH, Schwartz J, Moy A, Knaplund C, Kang MJ, Schnock KO, Garcia JP, Jia H, Dykes PC, Cato K, Albers D. Development and validation of early warning score system: A systematic literature review. *Journal of biomedical informatics*. 2020 Apr 8;103410. doi: 10.1016/j.jbi.2020.103410.
12. Jones M. NEWSDIG: The national early warning score development and implementation group. *Clinical medicine*. 2012 Dec;12(6):501. doi: 10.7861/clinmedicine.12-6-501
13. Williams B. The National Early Warning Score 2 (NEWS2) in patients with hypercapnic respiratory failure. *Clinical Medicine*. 2019 Jan;19(1):94. doi: 10.7861/clinmedicine.19-1-94

14. Sbiti-Rohr D, Kutz A, Christ-Crain M, Thomann R, Zimmerli W, Hoess C, Henzen C, Mueller B, Schuetz P. The National Early Warning Score (NEWS) for outcome prediction in emergency department patients with community-acquired pneumonia: results from a 6-year prospective cohort study. *BMJ open*. 2016 Sep 1;6(9).
<http://dx.doi.org/10.1136/bmjopen-2015-011021>
15. Kaya AE, Ozkan S, Usul E, Arslan ED. Comparison of pneumonia severity scores for patients diagnosed with pneumonia in emergency department. *Indian Journal of Medical Research*. 2020 Apr 1;152(4):368. doi: 10.4103/ijmr.IJMR_595_18
16. Zhou HJ, Lan TF, Guo SB. Outcome prediction value of National Early Warning Score in septic patients with community-acquired pneumonia in emergency department: A single-center retrospective cohort study. *World Journal of Emergency Medicine*. 2020;11(4):20 doi: 10.5847/wjem.j.1920-8642.2020.04.0026.
17. Williams B. The National Early Warning Score 2 (NEWS2) in patients with hypercapnic respiratory failure. *Clinical Medicine*. 2019 Jan;19(1):94. doi: 10.7861/clinmedicine.19-1-94

Figures

Diagonal segments are produced by ties.

[AUC (95% CI), p-value] for NEWS2 = [0.725 (0.632-0.818), p=0.000]. [AUC (95% CI), p-value] for PSI = [0.669 (0.568-0.769), p=0.002]

Figure 1

Predictive validity of NEWS 2 and PSI scoring for severity of CAP to in-hospital outcome

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [STROBEchecklistv4combined.doc](#)
- [PSIvNEWStable1.pdf](#)

- [Table2NEWSvPSI.pdf](#)
- [Table3NEWSvPSI.pdf](#)