

# A Novel Metabolic Index as a Predictor of Mortality in Critical Care

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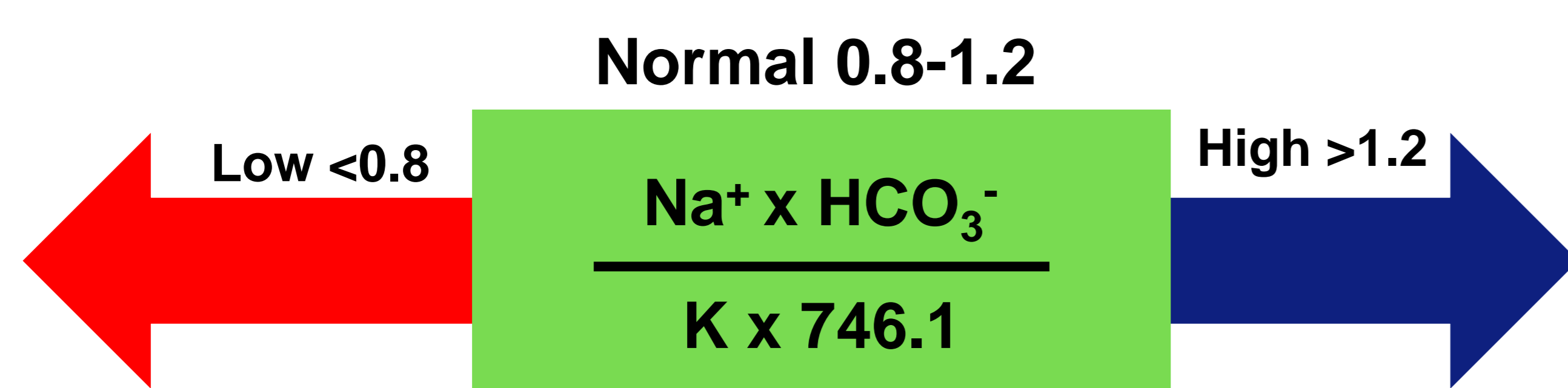
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## Introduction and Objectives

There has been a 22% increase in Accident and Emergency (A&E) attendances in England since 2007-2008 (1). Failure to recognise critically ill patients delays escalation to intensive care units (ICU) and results in increased mortality (2, 3). Objectively identifying the sickest patients on admission remains challenging for healthcare professionals. Acid-base and electrolyte equilibrium disorders are common in critically ill patients and metabolic markers have been proposed as potentially useful triage tools in A&E (4)

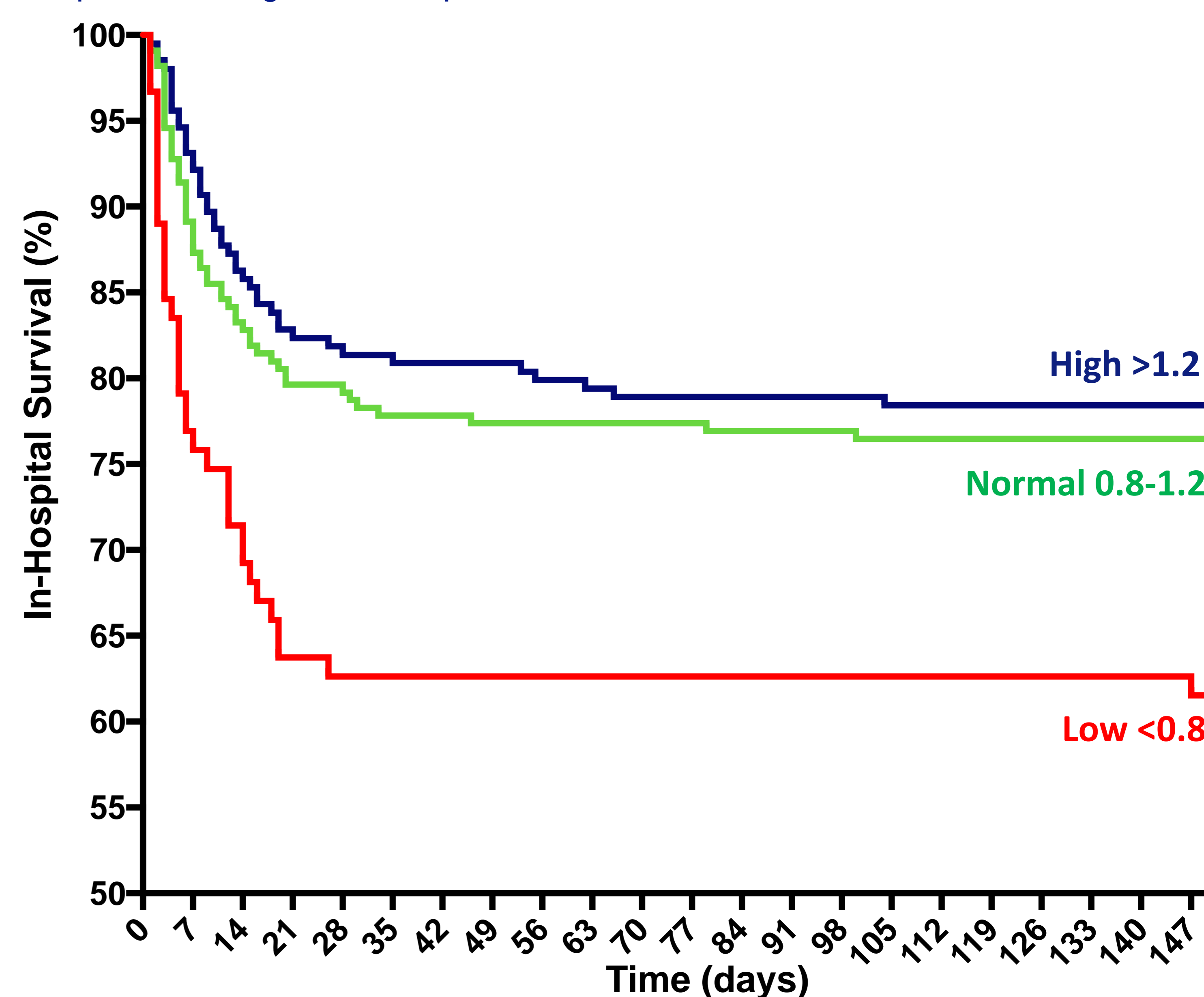
## Methods

17,346 patients had received an arterial or venous blood gas test in the Accident and Emergency (A&E) departments of St Mary's and Charing Cross hospitals between March 2017 and March 2018. Of these, 516 patients were identified to have been transferred to ICU. These were followed up to primary end-point; hospital discharge or in-hospital death.

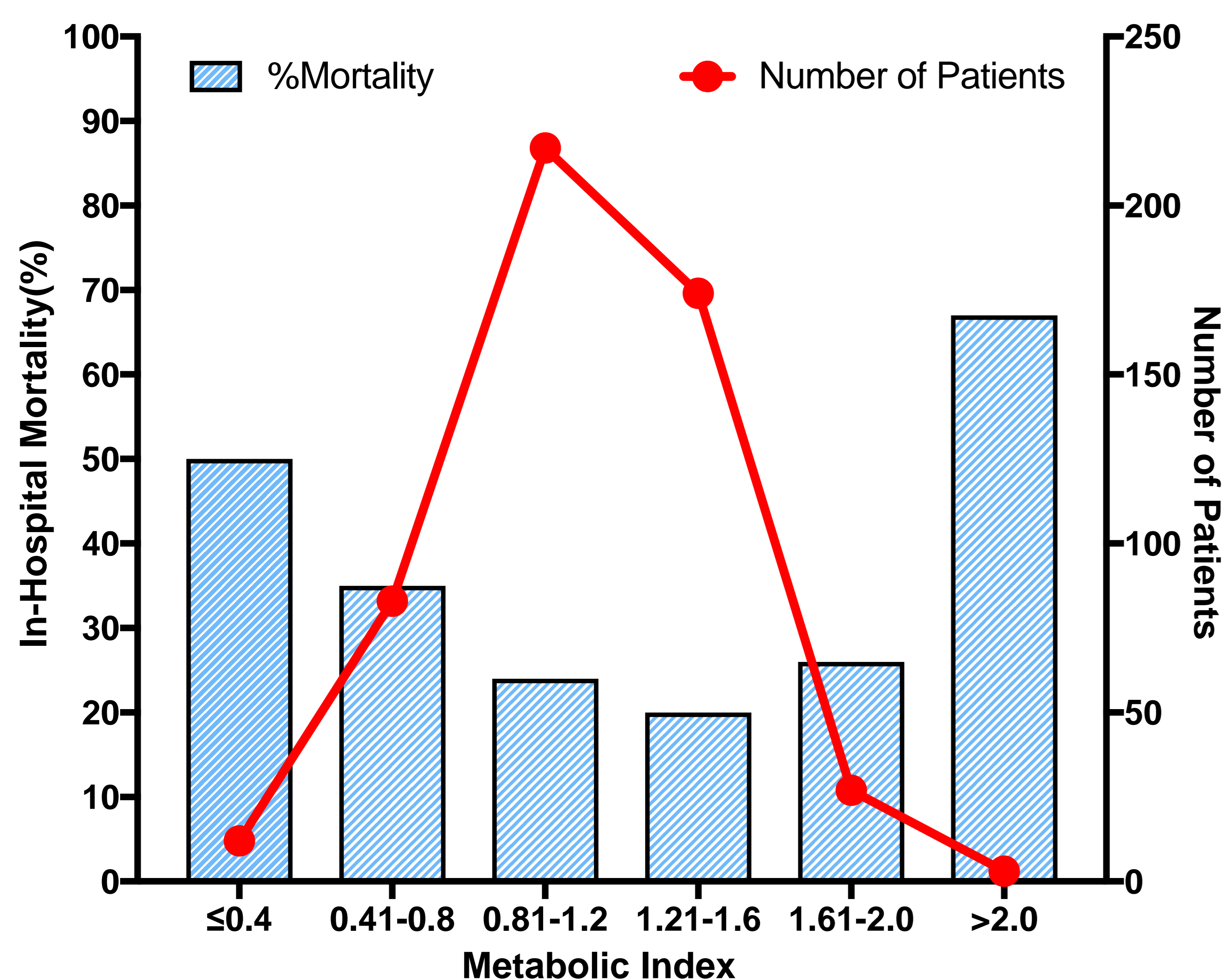


**Figure 1.** Calculation of Metabolic Index using sodium, potassium and bicarbonate values on admission (Low <0.8, Normal 0.8-1.2, High >1.2).

This study proposes a novel Metabolic Index as a marker of metabolic disturbance based on a patient's sodium, potassium and bicarbonate [Figure 1]. The Metabolic Index is proposed as a predictor of outcome in patients presenting to A&E. A Metabolic Index of 0.8-1.2 was defined as normal. The objective of this study was to investigate the association between Metabolic Index value on admission and transfer to ICU and subsequent mortality.



**Figure 3.** In-hospital survival from admission in patients transferred to ICU according to low (<0.8), normal (0.8-1.2) and high (>1.2) Metabolic Index (n = 516) (p = 0.0017)



**Figure 2.** In-hospital ICU mortality of patients transferred to ICU according to Metabolic Index (n = 516)

## Results

Sub-categorising Metabolic Index values into 0.4 intervals demonstrated a u-shaped trend with percentage mortality in ICU patients [Figure 2]. Patients who died in ICU were significantly more likely to have had a low Metabolic Index value on admission (OR 2.03, 95% CI 1.22-3.46, p=0.0075). Mantel-Cox test demonstrated significantly different survival in ICU between the low, normal and high groups (p = 0.0017) [Figure 3]. Binomial logistic regression, adjusted for age and gender, revealed that a low Metabolic Index on admission was an independent predictor of mortality in ICU (OR 2.004, 95% CI 1.171 – 3.429, p = 0.011).

## Conclusion

This study demonstrates the potential use of a novel Metabolic Index to assess overall metabolic disturbance and objectively predict outcome in patients on presentation to A&E. This Metabolic Index could easily be incorporated into clinical practice. Further work is needed, including prospective studies to control for confounders and to assess whether serial Metabolic Index calculations are stronger predictors of outcome.

## References

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