

# Association of Potassium with Mortality: Data from a Metropolitan Safety-Net Hospital

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## Introduction

- Extremes of potassium levels have been associated with adverse outcomes.
- We examined the association between serum potassium values and mortality in patients hospitalized at Hennepin County Medical Center, an academic metropolitan safety-net hospital in Minneapolis.

## Methods

- We obtained potassium values for all patients hospitalized over a 1-year period (July 1, 2014-June 30, 2015), and used the last potassium value for each hospitalization for further analyses.
- We analyzed the association between potassium level and in-hospital mortality.
- We also assessed the percentage of patients with potassium  $\geq 5.0$  mEq/L overall and by comorbidity (diabetes, chronic kidney disease, heart failure).
- Comorbid condition information was obtained from problem lists and inpatient and outpatient diagnosis codes.

## Methods (cont.)

- We used probability density functions to display distributions of potassium values, showing the relative likelihood of potassium values falling within a particular range; total area under each curve equals one.
- For hospitalized patients with more than one potassium value, we calculated within-hospitalization standard deviations, and assessed the association with mortality.

## Results

- We included 17,317 hospitalizations with potassium values, among 11,827 patients.
- The mean age was 50.2 years; 57.3% of patients were male, 47.5% white, 33.5% black; 35.6% had diabetes, 27.4% chronic kidney disease, and 18.6% heart failure.
- We found a U-shaped relationship between potassium and mortality, with the lowest risk between 3.5 and 5.0 mEq/L. Mortality rates were  $>80\%$  for patients with values  $\geq 7$  mEq/L, and 12.3% for patients with values  $<3$  mEq/L.

Figure 1. Distribution of potassium values, overall

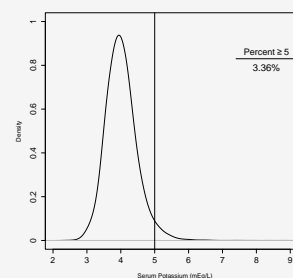


Figure 2. Distribution of potassium values, by race

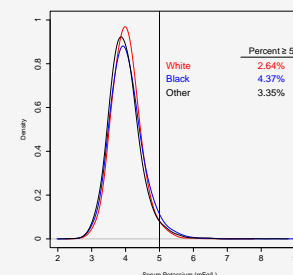


Table 1. Distribution of Potassium Values, Overall and for Heart Failure Patients

K (mEq/L)	Overall	Heart Failure
< 3.0	57 (0.33%)	11 (0.34%)
3.0 - <3.5	1,313 (7.58%)	194 (6.02%)
3.5 - <5.0	15,366 (88.73%)	2,777 (86.16%)
5.0 - <5.5	449 (2.59%)	192 (5.96%)
5.5 - <6.0	88 (0.51%)	35 (1.09%)
6.0 - <6.5	27 (0.16%)	9 (0.28%)
6.5 - <7.0	10 (0.06%)	3 (0.09%)
7.0+	7 (0.04%)	2 (0.06%)

Figure 3. Distribution of potassium values, by diabetes status

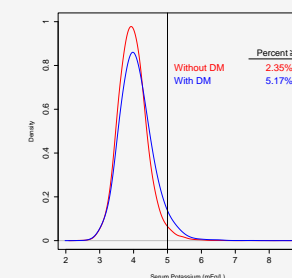


Figure 4. Distribution of potassium values, by chronic kidney disease status

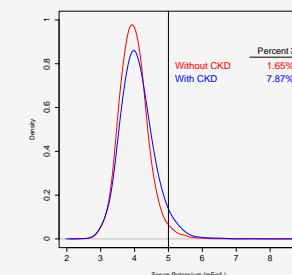


Figure 5. Distribution of potassium values, by heart failure status

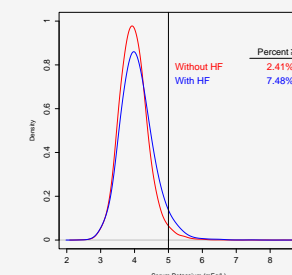


Figure 6. Relationship between potassium and mortality

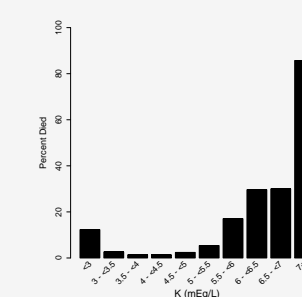


Table 2. Logistic Model Assessing Relationship Between Potassium and Mortality

	OR	95% CI	
		Lower	Upper
K 5.0 - <6.0 (vs <5.0)	4.24	2.94	6.11
K 6.0+ (vs <5.0)	43.54	22.26	85.19
Male	1.17	0.93	1.47
Black (vs white)	2.56	1.79	3.67
Other (vs white)	2.14	1.57	2.92
Age (continuous)	1.03	1.03	1.04
DM	0.58	0.45	0.75
CKD	1.16	0.88	1.51
HF	1.78	1.38	2.31

Table 3. Logistic Model Assessing Relationship Between Potassium Standard Deviation (K SD) and Mortality

	OR	95% CI	
		Lower	Upper
K SD (per 0.1 increase)	1.25	1.20	1.29
Male	1.12	0.88	1.42
Black (vs white)	2.15	1.46	3.15
Other (vs white)	2.20	1.59	3.03
Age (continuous)	1.04	1.03	1.04
Number of Ks (cont)	1.05	1.04	1.05

## Conclusions

- Although both low and high potassium values were associated with a higher risk of mortality, the risk increased once potassium exceeded 5.5 mEq/L and increased markedly thereafter.
- Limitations: Observational data with likely occurrence of confounded relationship of serum potassium and mortality (i.e., high serum potassium is a marker for severe, life-threatening illness).
- It is unclear how much of the observed mortality is directly attributable (and potentially preventable) to hyperkalemia (or hypokalemia) vs. other serious illnesses (e.g., sepsis, acute myocardial infarction, trauma) accompanied by extremes of serum potassium values.
- Prospective clinical trials on the prevention and treatment of hyperkalemia (and its effect on mortality) are warranted.

