

# Hyperkalemia Is Prevalent in Patients with Cardiorenal Comorbidities

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## Background

- Establishing population-based estimates of the prevalence of hyperkalemia is challenging because few large, nationally distributed patient-level databases containing laboratory information are available for analysis, and medical claims databases tend to underestimate prevalence of hyperkalemia because it is rarely reported as a primary diagnosis.<sup>1</sup>
- Consequently, our understanding of hyperkalemia prevalence is largely based on relatively small or narrowly defined patient populations.<sup>2-4</sup>
- This analysis investigated the prevalence of hyperkalemia in patients with chronic kidney disease (CKD), heart failure (HF), hypertension (HTN) and diabetes mellitus (DM) versus a comparison group of patients with none of these conditions except hypertension within a large medical records database.

## Methodology

- De-identified medical records (2008–2012) of individuals aged ≥5 years with at least 2 serum potassium measurements were evaluated from a large US database (N=1.7 million/7 million, including both insured [private, Medicare and Medicaid] and uninsured patients) (Humedica, Cambridge, MA).
- Inclusion criteria covered all patients with at least 1 valid serum potassium value (between 2.5 and 10 mEq/L; 99.7% of observations) during 2008–2012. Patients with acute kidney injury were excluded.
- Database prevalence of hyperkalemia was calculated cumulatively for the time period 2008–2012 and classified as mild (5.1–5.4 mEq/L) or moderate-to-severe (≥5.5 mEq/L), based on each patient's highest valid serum potassium result during the period, irrespective of setting of care.
- Comorbidities and age were assessed as of the patient's highest serum potassium value. Comorbidities included CKD by stage (by estimated glomerular filtration rate [eGFR] laboratory value or ICD-9 diagnosis code 585.2–5), end-stage renal disease (ESRD, eGFR <10 or diagnosis code 585.6), HF (diagnosis code or ejection fraction), diabetes (diagnosis code, HbA1c ≥6.5%, or diabetes medication), hypertension (diagnosis code) and selected combinations of these conditions.
- A comparison group was constructed of patients without CKD stage 2 or higher, ESRD, HF or DM.

## Results

### Patient Population

- 1,636,337 persons (mean age 56.1 years; 56% female) were included in the analysis (Table 1).

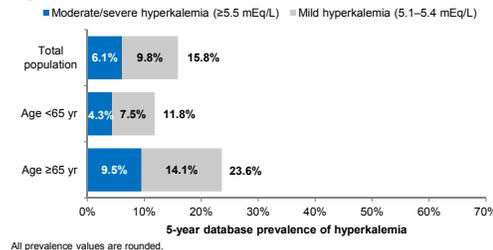
Table 1. Population Characteristics

	Age in years	
	<65	≥65
<b>Total population, N (%)</b>	1,072,900 (65.6)	558,308 (34.1)
<b>Gender, n (%)</b>		
Female	601,579 (56)	318,686 (57)
Male	471,321 (44)	239,622 (43)
<b>Age in years, mean (SD)*</b>	45.9 (13.2)	75.6 (7.1)
<b>Comorbidity prevalence, n (%)</b>		
HF	25,444 (2)	61,099 (11)
DM	165,501 (15)	149,658 (27)
Hypertension	334,670 (31)	321,909 (58)
CKD		
None/CKD stage 1	831,906 (78)	91,366 (16)
CKD stage 2	185,179 (17)	297,662 (53)
CKD stage 3a	25,300 (2)	75,421 (14)
CKD stage 3b	13,116 (1)	51,634 (9)
CKD stage 4	7796 (1)	29,651 (5)
CKD stage 5	1597 (<1)	3887 (1)
ESRD	7107 (1)	7199 (1)
CKD stages 3–4	47,111 (4)	158,194 (28)
CKD stages 3–4 with HF	5089 (<1)	30,219 (5)
<b>Comparison group, n (%)</b>	719,006 (67)	68,068 (12)
<b># of years in which serum potassium was tested at least once, n (%)</b>		
1	272,573 (25)	129,726 (23)
2	394,161 (37)	173,971 (31)
3	189,374 (18)	97,054 (17)
4	122,566 (11)	74,161 (13)
5	94,226 (9)	83,396 (15)

\*Age is calculated in reference year based on year of birth; to maintain privacy, all patients born in 1924 or earlier were assigned to 1924 as a birth. Data not shown for 5129 persons (0.3%) for whom age and gender were withheld for privacy reasons.

- 15.8% of the study population had at least 1 hyperkalemia event during the study period, 38% of those events involved serum potassium values ≥5.5 mEq/L (Figure 1).
- Older patients (≥65 year) were approximately twice as likely to experience hyperkalemia as patients younger than 65 years.

Figure 1. 5-Year Hyperkalemia Prevalence – Total Study Population

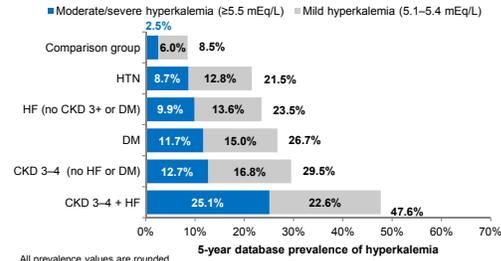


All prevalence values are rounded.

## Results (Cont.)

- A much higher % of patients with comorbidities known to be associated with the risk of hyperkalemia experienced such events compared to patients without the target comorbidities (Figure 2).
- Nearly half (47.6%) of all patients with CKD stages 3–4 + HF had at least 1 hyperkalemia event compared to 8.5% of the comparison group.

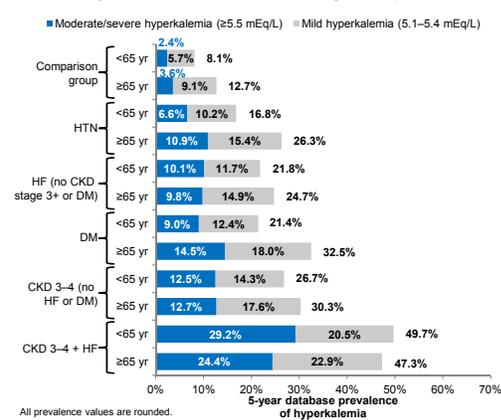
Figure 2. 5-Year Database of Hyperkalemia, Stratified by Patient Comorbidities



All prevalence values are rounded.

- Within comorbidity groups, prevalence of hyperkalemia is uniformly high and the age-group differences in hyperkalemia prevalence are much narrower, suggesting that the effect of age is mitigated in patients with target comorbidities (Figure 3).

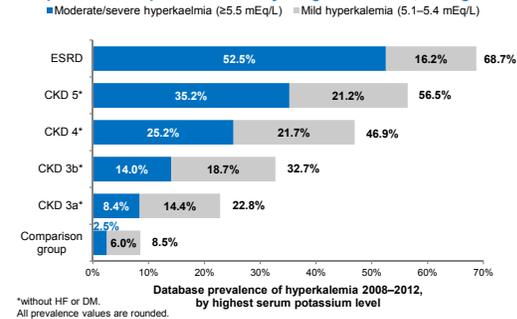
Figure 3. 5-Year Database Prevalence of Hyperkalemia, Stratified by Patient Comorbidities and Age Group



All prevalence values are rounded.

- Prevalence of hyperkalemia increases steadily among CKD patients as disease progresses, and the proportion of patients experiencing moderate-to-severe versus mild hyperkalemia is higher at more advanced stages of CKD (Figure 4).

Figure 4. 5-Year Database Prevalence of Hyperkalemia, Comparison Group versus CKD by Stage and ESRD, All Ages



\*without HF or DM. All prevalence values are rounded.

## Discussion and Conclusion

- In this analysis of over 1.6 million patients, hyperkalemia was more prevalent in patients with each measured comorbidity compared to patients without comorbidities; patients with DM, HF, CKD stages 3–4 and combinations of these conditions were 2.5 to 5.6 times more likely to experience hyperkalemia than patients without any of these conditions.
- Hyperkalemia was both more frequent and more severe as kidney function deteriorated.
- A limitation of this analysis is that conclusions about prevalence cannot be directly generalized to the US population because this database has not been normalized to census data. In addition, detection of hyperkalemia is limited to the availability of potassium test results in this population, resulting in variable follow-up periods between patients.
- In conclusion, these findings from a large population analysis confirm that as patient morbidity increases, either through declining renal function and/or the development of concomitant disease, the prevalence of hyperkalemia increases.

### References

1. HCUP National Inpatient Sample (NIS). [www.hcup-us.ahrq.gov/nisoverview.jsp](http://www.hcup-us.ahrq.gov/nisoverview.jsp). 2. Elacki E et al. *Med Princ Pract*. 2015 Mar 11 [Epub ahead of print]. 3. Einhorn LM et al. *Arch Intern Med*. 2009;169:1156–1162. 4. Sadjadi SA et al. *Thromb Clin Risk Manag*. 2009;5:647–652. Poster Sponsoring was provided by Prime Medica Ltd funded by Relypsa, Inc.