Systolic Blood Pressure Threshold and Clinical Outcomes in CKD 4/5 Patients

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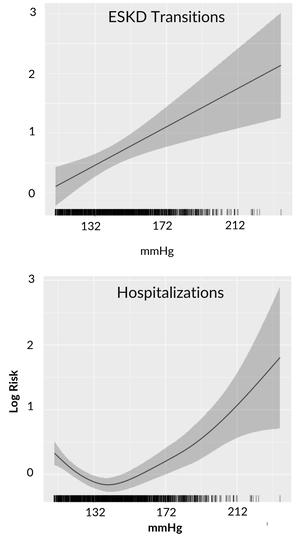
Introduction and Objective

- Kidney Disease Improving Global Outcomes (KDIGO) guidelines suggest targeting a systolic blood pressure (SBP) <120 mmHg for individuals with chronic kidney disease (CKD).[1] However, recent research suggests that intensively lowering BP (<120mmHg) in individuals with CKD was associated with a higher risk of ≥50% eGFR decline or transition to end-stage kidney disease (ESKD) during the intervention phase.[2]
- Still, there is a paucity of published evidence directly comparing relevant health outcomes across various SBP targets.
- Therefore, we investigated the possible impact of various SBP targets on hospitalizations, mortality, and ESKD transitions among individuals with CKD stage 4/5.

Methods

- We used the Optum® de-identified Integrated Clinical-Claims Dataset[3] (2017-2021) that links administrative claims and clinical data from providers across the continuum of care.
- Time updated analysis with observations determined by each recorded SBP that met inclusion criteria.
- Individuals were eligible to contribute multiple qualifying SBP intervals.
- Inclusion criteria:
  - Pre-existing CKD 4/5 diagnosis
  - Ongoing treatment with ≥1 antihypertensive medication
  - SBP ≥110 mmHg (to minimize potential confounding from cardiac failure)
- At-risk time was determined by the number of days between the qualifying SBP and any subsequent SBP measurement, or censoring. At-risk time and events during this interval were attributed to the corresponding exposure group.
- In parallel analyses, we attributed SBP as conforming, or not conforming, to potential guideline thresholds (<120, <130, or <140 mmHg).
- We then used the method of recycled predictions to estimate the effect of time updated SBP aligned to guideline targets (separately for <120, <130, and <140 mmHg) on clinical outcomes accounting for clinical confounders.
  - Recycled predictions are a method for estimating the marginal effect of independent variables on a dependent variable. They are calculated by averaging predicted scores on the dependent variable after fixing the value of one independent variable, while using observed values for the remaining independent variables.[4]

Figure 1. Continuous SBP and Risk



Data is presented continuously to better reflect the SBP outcome relationships across a range of distribution, and to aid in the dichotomous evaluation in the objective.

Results

Table 1: Patient Characteristics

	Overall N=973
Age, mean (SD)	76.2 (9.4)
Female, n (%)	503 (51.7)
Systolic Blood Pressure, mean (SD)	136 (17.8)
Race, n (%)	
Black	165 (17.0)
Asian	16 (1.6)
White	719 (73.9)
Other/Unknown	73 (7.5)
Ethnicity, n (%)	
Hispanic	40 (4.1)
Not Hispanic	827 (85.0)
Unknown	106 (10.9)
CKD Stage, n (%)	
4	878 (90.2)
5	95 (9.8)
Primary Insurance, n (%)	
Commercial	167 (17.2)
Medicaid	5 (0.5)
Medicare	788 (81.0)
Unknown	13 (1.3)
Any BP medications, n (%)	82 (39.3)
Any diabetes medications, n (%)	112 (11.5)

Table 2. Clinical Outcomes by SBP

	SBP Threshold (mmHg)	Follow-up years	Mortality		Hospitalization		ESKD Transitions	
			Deaths per 100 patient years	Anticipated Average Change	Admits per 100 patient years	Anticipated Average Change	Transitions per 100 patient years	Anticipated Average Change
Analysis #1	Not <140	577	10.6	Ref.	51.7	Ref.	10.4	Ref.
	<140	1,134	12.3	+1.8 (-1.7, +5.3)	52.9	+0.3 (-6.0, +6.4)	5.6	**-2.3 (-4.5, -0.3)**
Analysis #2	Not <130	1,039	11.1	Ref.	48.5	Ref.	7.9	Ref.
	<130	672	12.8	+1.9 (-1.7, +5.4)	58.6	+8.2 (-0.1, +16.6)	6.1	-0.6 (-2.3, +1.1)
Analysis #3	Not <120	1,455	11.2	Ref.	50.4	Ref.	7.6	Ref.
	<120	257	14.8	+4.0 (-3.0, +11.8)	64.3	+7.9 (-5.7, +21.9)	5.1	-1.5 (-3.7, +0.7)

Bold indicates statistical significance.

Summary of Findings

- SBP <140 mmHg is associated with lower rates of ESKD transition, no significant difference on hospitalization or mortality rates.
- SBP <130 or <120 did not have observable associations with ESKD transition, hospitalization, or mortality rates.

Conclusions

- While no definitive evidence supports a specific SBP threshold; if a threshold must be chosen, 140 mmHg appears to be a safer threshold for individuals with advanced CKD.

Limitations

- A bigger sample size is needed to be conclusive in threshold levels for SBP standard of care.
- Additionally, further investigation into the non-linear relationships of time-updated SBP and patient outcomes is warranted.

References and Acknowledgements

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