

Association of Final Discharge Blood Pressure with Post-discharge Outcomes Using Electronic Medical Record Data: a Retrospective Study



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Abbreviations

EMR	Electronic medical record
GFR	Glomerular filtration rate
SBP	Systolic blood pressure
AHRQ	Agency for Health Care Research and Quality
AOR	Adjusted odds ratio
UOR	Unadjusted odds ratio

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INTRODUCTION

Abnormal blood pressures are common at hospital discharge; however, few studies have examined the association between discharge systolic blood pressure (SBP) and short-term post-discharge outcomes.^{1,2} We examined the association between the last SBP measured during a hospitalization and the odds of 30-day readmission and/or mortality.

METHODS

The institutional review board at the University of Minnesota approved this study. We included 94,974 emergent hospital admissions from 57,063 patients within a six-hospital network in the Minneapolis/St. Paul area, MN, over 4 years (2012–2016). We excluded non-emergent admissions, patients less than 18 years of age, those who did not consent to their medical record being used for research purposes, or had less than 31 days of follow-up mortality data. We also excluded patients that died during their hospital stay or were discharged to hospice. Our database had complete death records from 2011 onwards for all Minnesotans. In order to avoid bias introduced by repeated measurements from a single patient, we randomly sampled the original dataset to include only one encounter for each patient. SBP was stratified as < 80 mmHg, 80–100 mmHg, 100–110 mmHg, 110–120 mmHg, 120–140 mmHg, 140–160 mmHg, 160–180 mmHg, and > 180 mmHg. We used logistic regression to assess the relationship between SBP and death or readmission within 30 days of

the index hospitalization, adjusting for age, sex, race, body mass index, length of stay, AHRQ comorbidities, estimated glomerular filtration rate (eGFR), serum albumin, hemoglobin, sodium, bilirubin, and platelet counts (R Studio, v 1.1.463).

RESULTS

Patient demographic and clinical characteristics are shown in Table 1. Physiological parameters or biochemical values were not significantly different amongst the two groups. Patients with 30-day death or readmission had worse renal function (creatinine 1.0 vs. 1.4, $p < 0.001$) and higher glucose values (112 mg/dL vs. 125 mg/dL, $p < 0.001$). Table 2 shows the association of discharge systolic blood pressure with 30-day mortality and readmission. The highest odds of 30-day readmission or death were associated with SBP of less than 80 mmHg (adjusted OR 4.47, 95% CI 3.03–6.59). Discharge SBP of greater than 140 also had higher odds of adverse events (for SBP 140–160, 160–180, and > 180, UOR 1.09, CI 1.03–1.15, UOR 1.42, CI 1.30–1.56, and UOR 1.62, CI 1.30–2.02 respectively). However, after controlling for covariates, this significance was lost (AOR 0.88, CI 0.80–0.97, AOR 0.93, CI 0.79–1.08, and AOR 1.17, CI 0.81–1.68 respectively).

DISCUSSION

Currently, there are no guidelines as to what constitutes a “safe” discharge SBP.^{1,3,4} In our study, a discharge SBP of 110–140 mmHg was associated with the lowest odds of adverse events in the 30 days post-hospitalization. The odds of 30-day mortality/readmission increased at SBPs < 110 mmHg—with the highest odds observed at SBP values < 80 mmHg. With SBP > 140 mmHg, the unadjusted odds of adverse events increased with the SBP and peaked at SBP > 180 mmHg. However, the adjusted odds were not significantly higher for SBPs above 140 mmHg. This suggests that the higher rates of adverse post-discharge events observed in this range were driven by patient comorbidities rather than the SBP.

Although we adjusted for a number of the most relevant variables, unmeasured variables could be potential

Prior Presentations None.

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Table 1 Characteristics of Discharged Patients Stratified by 30-Day Death or Readmission

Stratified by death or readmission within 30 days	Patients without 30-day death or readmission	Patients with 30-day death or readmission	<i>p</i> value
Number of patients	50,161	3629	
Demographics			
Age in years (mean (SD))	58.68 (20.11)	66.62 (18.04)	< 0.001
Male (%)	24,056 (47.96)	1789 (49.30)	0.123
Race/ethnicity (%)			
White	42,487 (84.70)	3142 (86.58)	
African American	3559 (7.10)	225 (6.20)	
Asian	1217 (2.43)	81 (2.23)	
American Indian/Alaskan Native	635 (1.27)	39 (1.07)	
Hispanic/Latino	882 (1.76)	55 (1.52)	
Native Hawaiian/Pacific Islander	48 (0.10)	5 (0.14)	
Clinical data			
Systolic BP (mmHg, mean (SD))	127.2 (18.6)	126.0 (20.8)	< 0.001
Diastolic BP (mmHg, mean (SD))	72.5 (12.7)	70.3 (13.6)	< 0.001
Body mass index (mean (SD))	35.4 (406.4)	27.7 (7.7)	0.259
Length of stay in days (mean (SD))	3.7 (4.0)	5.2 (5.1)	< 0.001
Discharge disposition (%)			
Acute rehab facility	731 (1.46)	49 (1.35)	
Expired	0 (0.00)	0 (0.00)	
Home IV drug therapy	431 (0.86)	42 (1.16)	
Home or self-care	34,249 (68.28)	1407 (38.77)	
Home with home health care	4390 (8.75)	552 (15.21)	
Home hospice	0 (0.00)	0 (0.00)	
Left against medical advice	487 (0.97)	35 (0.96)	
Psychiatric hospital	607 (1.21)	39 (1.07)	
Another short-term hospital	1102 (2.20)	226 (6.23)	
Skilled nursing facility	6941 (13.84)	973 (26.81)	
Other	1223 (2.44)	306 (8.43)	

confounders. Furthermore, our findings do not apply to specific subgroups such as patients with heart failure, end-stage liver disease, or post-acute stroke populations. Finally, we may have underestimated readmission rates since we only had data for our hospital network.

Despite these limitations, our study highlights a significant association between abnormal discharge SBP (< 110 mmHg or > 140 mmHg) and increased 30-day mortality and readmission. The higher rates of 30-day readmission and death observed in patients with discharge SBPs in the 140–180-mmHg range may be at least partially due to their medical comorbidities. Ultimately, clinical trials are needed to further understand

the nature of the link between discharge blood pressure and post-discharge adverse events.

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Compliance with Ethical Standards:

The institutional review board at the University of Minnesota approved this study.

Conflict of Interest: The authors declare that they do not have a conflict of interest.

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Table 2 Systolic Blood Pressure and Its Relationship with Death or 30-Day Readmission

SBP (mmHg)	Number of patients	Adjusted odds ratio	Unadjusted odds ratio
< 80	89	4.47 (3.03–6.59)	5.10 (3.98–6.55)
80–100	3425	2.03 (1.83–2.26)	1.83 (1.70–1.96)
100–110	7026	1.39 (1.26–1.53)	1.22 (1.15–1.30)
110–120	10,238	Reference	Reference
120–140	20,369	1.01 (0.93–1.10)	1.01 (0.96–1.07)
140–160	10,299	0.88 (0.80–1.01)	1.09 (1.03–1.15)
160–180	2061	0.93 (0.79–1.08)	1.42 (1.30–1.56)
> 180	254	1.17 (0.81–1.68)	1.62 (1.30–2.02)

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