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Title: Patient and Facility Characteristics Related to Hypertension Control After a Transient Ischemic Attack (TIA)

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Purpose:

The purpose of this study was to Identify patient and facility characteristics associated with hypertension control for TIA patients in the 90 days following discharge from an ED or inpatient setting.

Hypertension is one of the risk factors targeted for better management by the United States Veterans Health Administration (VHA), the largest health system in the nation with 168 VHA Medical Centers and 1,053 outpatient sites of care of varying complexity (VHA outpatient clinics), serving more than 8.9 million Veterans each year. Hypertension control is particularly important after a TIA, as it can be a major factor in preventing a recurrent stroke ([Kernan et al., 2014](#)) or other vascular event.

Hypertension control after a stroke or TIA is often below accepted targets ([Ovbiagele et al., 2011](#)). Prior work in the VHA system found that only 56% of stroke patients had blood pressure (BP) control (<140/90 mmHg) at 6 months post-discharge from their index hospitalization ([Ross et al., 2011](#); [Roumie et al., 2011](#); [Roumie et al., 2015](#)). Those studies found that the quality of care during an inpatient stay was generally unrelated to hypertension control or other risk management quality measures post-discharge for stroke patients. That research included patients with stroke but excluded TIA patients.

Relatively little is known about hypertension management for VHA patients after a TIA. While guidelines for treatment and interventions exist, providers may not systematically counsel patients regarding stroke and TIA prevention ([Schmid, Andersen, Kent, Williams, & Damush, 2010](#)). Interviews conducted in other studies by the authors suggest that TIA-patients care needs may be viewed as less urgent than patients with other disease processes. Specifically, TIA patients may not garner the same amount of attention by care providers as patients diagnosed with a stroke. Both patient and facility factors could contribute to or impede risk factor management for patients with a TIA. Gaining a better understanding of patient characteristics affecting hypertension management could help target patients for interventions. Identifying facility factors could guide system-level changes to improve care.

Methods:

We used electronic health record data to select a sample of 3676 patients with a TIA who were cared for in the emergency department (ED) or inpatient setting in 132 VHA facilities from October 2010 to September 2011. Patients with an ICD-9 code of 435.x excluding were classified as having a TIA. For patients who were cared for in the ED only, the ICD-9 code for their ED visit was used; for patients who were admitted, the primary discharge diagnosis code was used. Patients were excluded from the analysis if they did not have valid BP measurements within 90 days of discharge, died during the index ED visit/hospitalization or within 90 days of discharge, were discharged to hospice, or were transferred to a non-VA acute care facility. A sample of 3508 TIA patients from 105 VHA facilities were included in the analyses.

VHA inpatient and outpatient data files were used to identify past medical history, healthcare utilization (e.g., hospitalizations, office visits) and receipt of procedures. Pharmacy Benefits Management (PBM) data were used to identify medications; Corporate Data Warehouse (CDW) data were used for vital signs, laboratory data allergies, orders, and consults. Finally, linked VHA-Centers for Medicare and Medicaid Services (CMS) data were used to identify comorbidity, and hospitalizations in non-VHA facilities.

The outcome variable was BP control at 90 days post-discharge from the index ED or inpatient admission. Control was defined as systolic BP <140 mmHg and diastolic blood pressure <90 mmHg. Other patient characteristics included BP control at discharge from the ED or inpatient setting; demographics of gender, age, marital status, and race (African American); and past medical history of hypertension, hyperlipidemia, sleep apnea, dialysis, and depression. Facility characteristics included VHA stroke center designation of primary stroke center or limited hours stroke facility, urban location, 25 or more stroke admissions per year, and FTE internal medicine staff.

For the outcome of BP control at 90 days we fit a hierarchical general linear model (HGLM) with a logit link function and a facility random effect. Independent variables were BP control at discharge, other patient characteristics, and facility characteristics.

Results:

At discharge, 58% of patient has their BP controlled, while at 90 days post-discharge, 78% of patients had their BP controlled. Ninety-five percent of the Veterans were male age. They had a mean age of 69 (SD=12). Fifty-one percent were married and 19% African American. Their past medical history included hypertension (82%), hyperlipidemia (76%), sleep apnea (19%), dialysis (3%), and depression (40%). Thirty-two percent of patients used the ED only and 68% had an inpatient admission, while 63% had a neurologist consult in the ED or inpatient setting. Fifty-nine percent of facilities had a VHA stroke center designation, 91% were in an urban location, 62% had 25 or more stroke admissions per year, and their internal medicine staffs averaged 1.1 FTE/100,000 patient visits.

As expected, patients with uncontrolled BP at discharge were significantly less likely to have BP control at 90 days (Adjusted Odds Ratio [AOR] .36, 95% CI [.30-.44]). Neither black race nor

other demographic variables were significantly related to BP control at 90 days. A history of hypertension (AOR .45, 95%CI [.30-.44]) and dialysis (AOR .57, 95%CI [.34-.96]) were associated with absence of BP control; whereas, patients with a history of hyperlipidemia (AOR 1.37, 95%CI [1.09-1.72]), sleep apnea (AOR 1.29, 95% CI [1.00-1.64]), and depression (AOR 1.27, 95% CI [1.04-1.54]) were significantly more likely to have BP control. Neither an inpatient admission (as opposed to ED only) nor having a neurology consult was related to subsequent BP control. Facility characteristics significantly related to BP control at 90 days were a stroke center designation (AOR 1.45, 95% CI [1.08-1.94]), being in the top quintile of FTE internal medicine staff (AOR 1.45, 95% CI [1.08-1.95]), and percentage of all patients with BP control (AOR 1.14, 95% CI [1.03-1.25]).

Conclusion:

We expected that patients with a history of hypertension and those with uncontrolled BP at discharge would be more likely to have uncontrolled BP at 90 days post-discharge.

Interestingly, patients admitted to the inpatient setting and those with a neurologist consult were no more likely to have their post-discharge BP controlled than patients seen only in the ED or without a neurologist consult. Risk factor management in the days and weeks after the TIA event may be the deciding factor in hypertension control rather than the setting for care immediately after the event. The role of comorbidities is complex. Patients with multiple conditions, such as a history of hyperlipidemia, sleep apnea, or depression, may have their risk factors managed more intensively after discharge. On the other hand, dialysis patients may be more difficult to manage due to fluctuations in BP due to fluid status. Our findings suggest that post-discharge hypertension management may be best achieved in facilities with a designated stroke center, greater primary care resources (FTE internal medicine) and a track record of better overall hypertension management.

In another arm of the study, we conducted interviews with health care providers at 14 high-volume VHA Medical Centers to inquire about successes and barriers to good TIA care. A major factor that stood out was the presence of an RN stroke coordinator, who was able to bridge the care transition post-discharge. The stroke care coordinator was pivotal in arranging for follow-up care in the stroke clinic, if available, and with the primary care provider.

Our study prompted a multisite intervention in VHA Medical Centers to improve quality of care through coaching and sharing of quality metrics. The intervention is taking advantage of existing VHA infrastructure and applying it to the care of patients with TIA. For example, we have created protocols and templates for pharmacists who were not previously involved in the care of either stroke or TIA patients and now they are serving as a bridge between the inpatient and outpatient settings. Similar protocols/templates have been developed to guide the post-discharge primary care RN calls to patients. We found that many patients had a history of poor BP control prior to their TIA. These patients may benefit from intensification of medications at discharge followed by appropriate monitoring through primary care ([Roumie et al., 2015](#)).

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