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## Effect of Insurance Status on Outcomes of Acute Ischemic Stroke Patients Receiving Intra-Arterial Treatment: Results from the Paul Coverdell National Acute Stroke Program

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### Abstract

**Background:** Stroke continues to be a leading cause of death and disability in the United States. Rates of intra-arterial reperfusion treatments (IAT) for acute ischemic stroke (AIS) are increasing, and these treatments are associated with more favorable outcomes. We sought to examine the effect of insurance status on outcomes for AIS patients receiving IAT within a multistate stroke registry.

**Methods:** We used data from the Paul Coverdell National Acute Stroke Program (PCNASP) from 2014 to 2019 to quantify rates of IAT (with or without intravenous thrombolysis) after AIS. We modeled outcomes based on insurance status: private, Medicare, Medicaid, or no insurance. Outcomes were defined as rates of discharge to home, in-hospital death, symptomatic intracranial hemorrhage (sICH), or life-threatening hemorrhage during hospitalization.

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Author contributions

Each author listed should receive authorship credit based on substantial contribution to this article, revision of this article, and final approval of this article for submission to this journal.

Data sharing

Na.

Declaration of Competing Interest

GA has nothing to disclose.

XT has nothing to disclose.

KL is a member of the adverse event committee for Abbott/St. Jude Medical.

SMCK has nothing to disclose.

MGG has nothing to disclose.

**Results:** During the study period, there were 486,180 patients with a clinical diagnosis of AIS (mean age 70.6 years, 50.3% male) from 674 participating hospitals in PCNASP. Only 4.3% of patients received any IAT. As compared to private insurance, uninsured patients receiving any IAT were more likely to experience in-hospital death (AOR 1.36 [95% CI 1.07–1.73]). Medicare (AOR 0.78 [95% CI 0.71–0.85]) and Medicaid (AOR 0.85 [95% CI 0.75–0.96]) beneficiaries were less likely but uninsured patients were more likely (AOR 1.90 [95% CI 1.61–2.24]) to be discharged home. Insurance status was not found to be independently associated with rates of sICH.

**Conclusions:** Insurance status was independently associated with in-hospital death and discharge to home among AIS patients undergoing IAT.

## Keywords

Insurance status; Intra-arterial treatment; Ischemic stroke; Outcomes

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## Background

Stroke continues to be a leading cause of death and serious disability in the United States.<sup>1</sup> The rates of acute ischemic stroke (AIS) treatment utilization, including intravenous thrombolysis (IVT) and intra-arterial treatment (IAT) among eligible patients, continue to increase and are associated with improved rates of favorable outcome.<sup>2</sup> The utilization of acute reperfusion treatments can result in a large benefit for AIS patients,<sup>3,4</sup> but there are disparities in treatment utilization. Overall IVT rates are lower among minorities and women when compared to whites and men, respectively.<sup>5,6</sup> Further, there is less frequent utilization of IAT among Black and Hispanic patients, and IAT may be underutilized among older patients.<sup>7</sup>

Besides racial and sex disparities, insurance status has been linked to underutilization of AIS treatments.<sup>7,8</sup> Patients with private insurance are more likely to undergo IAT,<sup>7</sup> and those who are uninsured or under-insured have limited access to hospitals that offer IAT.<sup>8</sup> The question remains whether insurance status has further impact on outcomes after the delivery of IAT. For instance, uninsured or Medicaid patients undergoing coronary reperfusion treatments are more likely to suffer in-hospital death as a result of more advanced chronic medical conditions.<sup>9</sup> We use a multistate stroke registry to examine the effect of insurance status on outcomes for AIS patients who receive IAT.

## Methods

The data that support findings within this study are available upon reasonable request by a qualified investigator from the corresponding author. We included patients with available insurance information admitted with a clinical diagnosis of AIS from 2014 through 2019 within the Paul Coverdell National Acute Stroke Program (PCNASP), which is funded by the Centers for Disease Control and Prevention (CDC). The PCNASP is an ongoing acute stroke quality improvement program and provides feedback to states on adherence to care guidelines in order to improve quality of care for patients hospitalized with stroke and transient ischemic attack (TIA). During our study period, there were 12 participating states (Arkansas, California, Georgia, Iowa, Massachusetts, Michigan, Minnesota, New York,

North Carolina, Ohio, Washington, and Wisconsin). Hospital participation within each state is voluntary. Trained abstractors collect detailed information on stroke and TIA admissions concurrent with or soon after hospital discharge using standard data definitions provided by the CDC.<sup>10,11</sup> The PCNASP is approved by the CDC Institutional Review Board.

We defined the rates of IAT only and IVT+IAT as percent of AIS admissions. Demographic information of patients included in the study were age, sex, and race. Baseline clinical characteristics of patients studied included stroke severity upon presentation as defined by the National Institutes of Health Stroke Scale (NIHSS) score, history of a previous stroke, hypertension, dyslipidemia, coronary artery disease, heart failure, diabetes mellitus, atrial fibrillation, or current tobacco use. Outcomes of stroke patients receiving any IAT were compared by insurance status, which included private, Medicaid, Medicare, or no insurance. Outcomes were defined as discharge to home, in-hospital death, symptomatic intracranial hemorrhage (sICH), or life-threatening hemorrhage (including sICH) during hospitalization.

We performed both univariate and multivariate logistic regression analyses using generalized estimating equations (GEE) to assess the effects of insurance status on outcomes for stroke patients receiving any IAT. Because patients were clustered within hospitals, the hospital was treated as a cluster variable in GEE models. Privately insured patients were set as the reference group in our models since they are more likely to undergo IAT.<sup>7</sup> We performed the following multivariate analyses: Model 1 adjusted for age, sex, race, stroke severity upon presentation, and arrival method to hospital; and, Model 2 included the addition of baseline comorbidities (previous stroke, hypertension, dyslipidemia, coronary artery disease, heart failure, diabetes mellitus, atrial fibrillation, or current tobacco use). All statistical analyses were performed using SAS software (version 9.4; SAS Institute, Cary, NC).

## Results

Among 496,983 AIS admissions between 2014 and 2019 in PCNASP, 10,803 (2.2%) did not have insurance status information. There were 486,180 patients with a clinical diagnosis of AIS (mean age 70.6 years, 50.3% male) from 674 participating hospitals (Table 1) with available insurance information included in our analysis. Medicare beneficiaries had the highest percent of patients at least 65 years of age (90.4%), and those with no insurance had the highest percent of patients younger than 65 years (84.8%). Medicare beneficiaries had the highest rate while those with private insurance or no insurance had the lowest rate of ambulance usage (50.0% and 36.1%, respectively). Presenting stroke severity was similar across all groups. Hypertension, dyslipidemia, coronary artery disease, heart failure, and atrial fibrillation were more common among Medicare beneficiaries than other groups. Diabetes mellitus was more common among Medicaid beneficiaries than other groups, and smoking was more common among Medicaid and no insurance groups.

Among the 20,856 (4.3%) patients who received IAT, 14,612 patients received IAT only, and 6,244 patients received IVT+IAT (Table 1). Patients with private insurance had the highest rate of any IAT (4.8%). This was followed by those with Medicaid (4.5%), no insurance (4.4%), and Medicare (4.1%). Table 2 shows the baseline and clinical characteristics among patients who received IAT by insurance status.

Outcomes of stroke patients receiving any IAT in our study can be found in Table 3. Overall 27.8% of patients receiving any IAT were discharged home from their acute hospitalization. The rate of in-hospital death was 12.8%, and sICH rate was 4.9%, while 0.6% of patients had life-threatening hemorrhages.

The effect of insurance status on outcomes of stroke patients receiving any IAT can be found in Table 4. In multivariate analysis Model 1, uninsured patients receiving any IAT were more likely to experience in-hospital death (AOR 1.36 [95% CI 1.07–1.73]). No such effect was found among Medicare and Medicaid beneficiaries for in-hospital death. Medicare beneficiaries (AOR 0.76 [95% CI 0.70–0.83]) and Medicaid beneficiaries (AOR 0.85 [95% CI 0.75–0.96]) were less likely but uninsured patients were more likely (AOR 1.91 [95% CI 1.62–2.25]) to be discharged home. Results did not change with the additional covariates in Model 2. Uninsured patients were more likely to experience in-hospital death (AOR 1.36 [95% CI 1.07–1.73]). Medicare (AOR 0.78 [95% CI 0.71–0.85]) and Medicaid (AOR 0.85 [95% CI 0.75–0.96]) beneficiaries were less likely and uninsured patients were more likely (AOR 1.90 [95% CI 1.61–2.24]) to be discharged to home. Insurance status was not found to be independently associated with rates of sICH in either model. We did not perform a comparative analysis of life-threatening hemorrhage due to the low rate among all IAT patients.

## Discussion

The number of uninsured Americans under the age of 65 years in the United States dropped from 48.2 million in 2010 to 30.1 million in 2018 following the passage of the Patient Protection and Affordable Care Act in 2010.<sup>12</sup> This decrease reflects insurance coverage made available through the expansion of Medicaid, provisions of health insurance subsidies, and an individual coverage mandate.<sup>13</sup> However, disparities still exist in access to care, outcomes, and utilization of healthcare resources. Guidelines strongly recommend IAT among eligible patients.<sup>14</sup> However, Rinaldo and colleagues evaluated rates of IAT between 2016 and 2018 and found that Medicaid beneficiaries and uninsured patients had lower rates of IAT utilization despite the widespread acceptance and increased overall IAT use.<sup>7</sup> In our study, a higher proportion of privately insured patients underwent IAT as compared to those with Medicare, Medicaid, or without insurance. Previous explanations for this disparity based on socioeconomic status included delays in presentation and stroke etiology.<sup>8</sup>

We found those without insurance to have a higher likelihood of suffering in-hospital death. Our findings are similar to what has been previously reported by Hasan and colleagues.<sup>15</sup> Specifically, privately insured patients had a lower likelihood of in-hospital death compared to those who are uninsured after adjustment for age, sex, race, arrival by ambulance, NIHSS scores, and comorbidities. Mortality differences could be due to risks imposed by poorly managed comorbidities among uninsured patients.<sup>15</sup> While we were able to adjust for many comorbidities, we are uncertain of how well controlled these chronic illnesses may be among the studied groups. Primary prevention is likely worse among the uninsured, and patients without insurance may be more likely to delay seeking treatment than those with insurance and present with more advanced stages of chronic diseases.<sup>16,17</sup> In a large administrative database study, Fargen and colleagues concluded that those without insurance

and Medicaid beneficiaries had 1.5 times higher odds of experiencing a poor outcome and 1.2 times higher odds of dying during their stroke hospitalizations.<sup>16</sup> While we were unable to identify a higher likelihood of in-hospital death among Medicaid beneficiaries, we were able to identify an approximately 36% higher chance of in-hospital death among the uninsured receiving IAT compared to their privately insured counterparts. Our findings are similar to the higher risks found for in-hospital death among uninsured patients undergoing percutaneous coronary interventions for coronary artery disease.<sup>9</sup> Given the likely high-quality processes of stroke care in hospitals, such as those who participate in PCNASP,<sup>10,11</sup> in-hospital outcomes may be independently associated with insurance status.<sup>18</sup> Pre-stroke health status, lifestyle choices and healthcare choices made by patients about how and when to seek medical care may be factors that contribute to in-hospital death but could not be accounted for in this study.<sup>18</sup>

Home discharge after an acute stroke hospitalization has been shown to result in a low likelihood of an unfavorable outcome among those receiving IVT,<sup>19</sup> and longer times spent at home (defined previously as the number of days during the 90-day post-stroke period that a patient resides at home) after receiving IAT has been shown to increase the chances of a long-term favorable outcome.<sup>20</sup> However, these reports stem from randomized clinical trials in which insurance information was not an inclusion or exclusion factor.<sup>21,22</sup> Among those who are uninsured, discharge destination may not be an accurate outcome measure. In our study uninsured patients receiving IAT were more likely to be discharged home, but we cannot assume that this suggests a higher rate of favorable outcomes among this group but instead indicates limited access to inpatient rehabilitation services.<sup>18</sup> Limited access to rehabilitation after ischemic stroke for uninsured populations may increase the number of patients who experience lower quality of life, which would increase long-term costs.<sup>18</sup> On the contrary, Medicare and Medicaid beneficiaries were less likely to be discharged home in our study. As Medicare patients were the oldest of those examined in our study, it is unclear if their pre-stroke living situations and levels of independence played roles in their discharge destination. The aging American population is becoming more dependent on paid caregiving, which are typically available in assisted living facilities or nursing homes; therefore, the predictive ability of discharge destination from acute hospitalizations for long-term outcomes should be further investigated.<sup>23</sup>

In our study, we did not identify an independent effect of insurance status on the development of sICH for those undergoing IAT. Among randomized trials in which a majority of patients received IVT+IAT as compared to standard medical care (including IVT only), there was no significant difference in developing sICH.<sup>4</sup> Similarly, among randomized trials in which the majority of patients received IAT only as compared to standard medical care, there was no significant difference in developing sICH.<sup>22,24</sup> Rates of sICH in our study are similar to those found in these clinical trials.<sup>4,22,24</sup>

The findings in our study can help guide future investigations on the effect of insurance status and outcomes associated with IAT. We identified a higher proportion of privately insured patients undergoing IAT as compared to the other cohorts in our study. This has been observed previously,<sup>7,8</sup> and further efforts are needed to understand the differences in utilization rates of IAT based on insurance status as the evidence in favor of IAT continue

to evolve. With the highest rate of in-hospital death among the uninsured population, eliminating financial barriers and increasing access to outpatient primary care may help manage chronic illnesses in order to improve in-hospital outcomes.<sup>9</sup> Finally and irrespective of insurance status, solutions to maximize stroke rehabilitation after hospitalization are needed irrespective to discharge destination. Our findings do not support that discharge destination alone can safely predict a favorable outcome.

Strengths of our study include the large number of patients and multistate data from a variety of hospitals collected during regular delivery of stroke care. We acknowledge important limitations. We are unable to assess the selection criteria for those receiving IAT to determine adherence to or deviation from institutional guidelines as it evolved over our study period.<sup>14</sup> We are also unable to account for time of symptoms onset to initiation of IAT. We had difficulties in ascertaining baseline disability in a proportion of patients, as defined by the NIHSS score (1.7% of patients undergoing IAT). We are also unable to track the changes in Medicaid expanding coverage through the current data collection and account on its impact in our analysis. Instead, we focused on the IAT treatments given within each insurance group as provided at admission and examined if insurance status at the time of hospital admission was associated with the outcomes of interest. Reporting bias may exist since participation in PCNASP is voluntary. A formal outcome scale was not available in our study to ascertain long-term disability, such as 90-day modified Rankin Scale score.

In conclusion, our analysis supports an independent association between insurance status and outcomes among AIS patients undergoing IAT. In particular, uninsured patients had a higher rate of in-hospital death. Medicare and Medicaid beneficiaries were less likely to be discharged home, and uninsured patients were more likely to be discharged home when compared to privately insured patients undergoing IAT. Our findings support creating efforts in addressing insurance-based disparities in the outcomes for AIS patients.

## Funding

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**Table 1.** Baseline and Clinical Characteristics Among Acute Ischemic Stroke Patients by Insurance Status, Paul Coverdell National Acute Stroke Program 2014–2019.

Variables	Overall n (%) or statistics (N = 486180)	N (%) or statistics by Insurance type			
		Medicaid (n = 40792)	Medicare (n = 313495)	Private (n = 113975) None (n = 17918)	
Mean age (SE)	70.6 (0.0)	56.4 (0.1)	76.9 (0.0)	60.4 (0.0)	56.0 (0.1)
Age in groups					
18–54	67972 (14.0)	16744 (41.0)	8949 (2.9)	34498 (30.3)	7781 (43.4)
55–64	93511 (19.2)	17605 (43.2)	21220 (6.8)	47279 (41.5)	7407 (41.3)
65–74	116967 (24.1)	3163 (7.8)	97451 (31.1)	14880 (13.1)	1473 (8.2)
75–84	115882 (23.8)	2079 (5.1)	102591 (32.7)	10321 (9.1)	891 (5.0)
85+	91848 (18.9)	1201 (2.9)	83284 (26.6)	6997 (6.1)	366 (2.0)
Males	244451 (50.3)	22179 (54.4)	144754 (46.2)	66275 (58.1)	11243 (62.7)
Race					
Non-Hispanic White	344916 (70.9)	17918 (43.9)	240408 (76.7)	78497 (68.9)	8093 (45.2)
Non-Hispanic Black	86137 (17.7)	13564 (33.3)	44778 (14.3)	21167 (18.6)	6628 (37.0)
Other race	55127 (11.3)	9310 (22.8)	28309 (9.0)	14311 (12.6)	3197 (17.8)
Arrival by ambulance	221791 (45.6)	17570 (43.1)	156592 (50.0)	41161 (36.1)	6468 (36.1)
Median NIHSS score [IQR]	3 [1, 9]	4 [1, 9]	4 [1, 9]	3 [1, 7]	3 [1, 7]
NIHSS scores in groups					
0–10	348829 (71.7)	29341 (71.9)	217897 (69.5)	88076 (77.3)	13515 (75.4)
11–20	59660 (12.3)	5238 (12.8)	40873 (13.0)	11593 (10.2)	1956 (10.9)
>20	31134 (6.4)	2332 (5.7)	22742 (7.3)	5191 (4.6)	869 (4.8)
Missing	46557 (9.6)	3881 (9.5)	31983 (10.2)	9115 (8.0)	1578 (8.8)
Medical history					
Previous stroke	126457 (26.0)	11586 (28.4)	88467 (28.2)	22989 (20.2)	3415 (19.1)
Hypertension	369323 (76.0)	29110 (71.4)	252102 (80.4)	76077 (66.7)	12034 (67.2)
Dyslipidemia	240362 (49.4)	15441 (37.9)	171757 (54.8)	48159 (42.3)	5005 (27.9)
Coronary artery disease	114111 (23.5)	7045 (17.3)	87084 (27.8)	17882 (15.7)	2100 (11.7)
Heart failure	51017 (10.5)	3789 (9.3)	39311 (12.5)	6861 (6.0)	1056 (5.9)
Diabetes mellitus	166463 (34.2)	15535 (38.1)	110538 (35.3)	35163 (30.9)	5227 (29.2)

Variables	Overall n (%) or statistics (N = 486180)	N (%) or statistics by Insurance type			
		Medicaid (n = 40792)	Medicare (n = 313495)	Private (n = 113975)	None (n = 17918)
Atrial fibrillation	94437 (19.4)	3198 (7.8)	77579 (24.7)	12628 (11.1)	1032 (5.8)
Current smoker	92597 (19.0)	16008 (39.2)	41431 (13.2)	27976 (24.5)	7182 (40.1)
Intra-arterial Treatment Received					
IAT only	14612 (3.0)	1289 (3.2)	9161 (2.9)	3594 (3.2)	568 (3.2)
IVT+IAT	6244 (1.3)	553 (1.4)	3598 (1.1)	1876 (1.6)	217 (1.2)
Any IAT	20856 (4.3)	1842 (4.5)	12759 (4.1)	5470 (4.8)	785 (4.4)

Abbreviations: IQR=interquartile range; IAT=intra-arterial treatment; IVT=intravenous treatment; NIHSS=National Institutes of Health Stroke Scale score; SE=standard error.

**Table 2.** Baseline and Clinical Characteristics Among Acute Ischemic Stroke Patients Receiving Intra-Arterial Treatment by Insurance Status, Paul Coverdell National Acute Stroke Program 2014–2019.

Variables	Overall n (%) or statistics (N = 20856)	Medicaid (n = 1842)	Medicare (n = 12759)	Private (n = 5470)	None (n = 785)
Mean age (SE)	69.5 (0.1)	54.8 (0.3)	76.8 (0.1)	59.2 (0.2)	57.0 (0.5)
Age in groups					
18–54	3298 (15.8)	829 (45.0)	314 (2.5)	1832 (33.5)	323 (41.1)
55–64	3962 (19.0)	741 (40.2)	717 (5.6)	2227 (40.7)	277 (35.3)
65–74	5015 (24.0)	142 (7.7)	4138 (32.4)	640 (11.7)	95 (12.1)
75–84	5106 (24.5)	94 (5.1)	4478 (35.1)	469 (8.6)	65 (8.3)
85+	3475 (16.7)	36 (2.0)	3112 (24.4)	302 (5.5)	25 (3.2)
Males	10357 (49.7)	1048 (56.9)	5660 (44.4)	3171 (58.0)	478 (60.9)
Race					
Non-Hispanic White	14744 (70.7)	832 (45.2)	9786 (76.7)	3762 (68.8)	364 (46.4)
Non-Hispanic Black	3049 (14.6)	549 (29.8)	1414 (11.1)	863 (15.8)	223 (28.4)
Other race	3063 (14.7)	461 (25.0)	1559 (12.2)	845 (15.4)	198 (25.2)
Arrival by ambulance	11847 (56.8)	1028 (55.8)	7339 (57.5)	3064 (56.0)	416 (53.0)
Median NIHSS score [IQR]	15 [9, 21]	15 [9, 21]	16 [10, 22]	14 [7, 19]	15 [9, 21]
NIHSS scores in groups					
0–10	6300 (30.2)	571 (31.0)	3558 (27.9)	1934 (35.4)	237 (30.2)
11–20	8717 (41.8)	779 (42.3)	5307 (41.6)	2291 (41.9)	340 (43.3)
>20	5479 (26.3)	463 (25.1)	3675 (28.8)	1146 (21.0)	195 (24.8)
Missing	360 (1.7)	29 (1.6)	219 (1.7)	99 (1.8)	13 (1.7)
Medical history					
Previous stroke	4129 (19.8)	342 (18.6)	2794 (21.9)	878 (16.1)	115 (14.6)
Hypertension	14706 (70.5)	1131 (61.4)	9916 (77.7)	3206 (58.6)	453 (57.7)
Dyslipidemia	9217 (44.2)	571 (31.0)	6544 (51.3)	1939 (35.4)	163 (20.8)
Coronary artery disease	4762 (22.8)	329 (17.9)	3529 (27.7)	808 (14.8)	96 (12.2)
Heart failure	2838 (13.6)	223 (12.1)	2079 (16.3)	463 (8.5)	73 (9.3)
Diabetes mellitus	5368 (25.7)	455 (24.7)	3590 (28.1)	1154 (21.1)	169 (21.5)
Atrial fibrillation	6792 (32.6)	253 (13.7)	5321 (41.7)	1105 (20.2)	113 (14.4)

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Variables	Overall n (%) or statistics (N = 20856)	Medicaid (n = 1842)	Medicare (n = 12759)	Private (n = 5470)	None (n = 785)
Current smoker	3725 (17.9)	718 (39.0)	1489 (11.7)	1273 (23.3)	245 (31.2)

Abbreviations: IQR=interquartile range; NIHSS=National Institutes of Health Stroke Scale score; SE=standard error.

**Table 3.**  
Outcomes of Stroke Patients Receiving Intra-Arterial Treatment Based on Insurance Status

Outcomes	Treatment	Overall n (%)	Medicaid	Medicare	Private	None
Discharge to home	IAT only	3642 (24.9)	411 (31.9)	1733 (18.9)	1236 (34.4)	262 (46.1)
	IVT+IAT	2160 (34.6)	229 (41.4)	961 (26.7)	836 (44.6)	134 (61.8)
In-hospital death	Any IAT	5802 (27.8)	640 (34.7)	2694 (21.1)	2072 (37.9)	396 (50.4)
	IAT only	1976 (13.5)	128 (9.9)	1378 (15.0)	397 (11.0)	73 (12.9)
	IVT+IAT	685 (11.0)	43 (7.8)	488 (13.6)	129 (6.9)	25 (11.5)
	Any IAT	2661 (12.8)	171 (9.3)	1866 (14.6)	526 (9.6)	98 (12.5)
Symptomatic ICH	IAT only	673 (4.6)	66 (5.1)	429 (4.7)	154 (4.3)	24 (4.2)
	IVT+IAT	340 (5.4)	31 (5.6)	212 (5.9)	83 (4.4)	14 (6.5)
Life-threatening hemorrhagic complications	Any IAT	1013 (4.9)	97 (5.3)	641 (5.0)	237 (4.3)	38 (4.8)
	IAT only	78 (0.5)	7 (0.5)	52 (0.6)	17 (0.5)	2 (0.4)
	IVT+IAT	57 (0.9)	1 (0.2)	45 (1.3)	10 (0.5)	1 (0.5)
	Any IAT	135 (0.6)	8 (0.4)	97 (0.8)	27 (0.5)	3 (0.4)

Abbreviations: IAT=intra-arterial treatment; IVT=intravenous treatment; ICH=intracranial hemorrhage.

**Table 4.** Effect of Insurance Status on Outcomes for Stroke Patients Receiving Intra-Arterial Treatments.<sup>a</sup>

	Model 1 <sup>*</sup>		Model 2 <sup>b</sup>	
	OR (95% CI)	AOR (95% CI)	OR (95% CI)	AOR (95% CI)
Symptomatic ICH	Private Insurance	Ref	Ref	Ref
	Medicare	1.17 (1.003–1.36)	1.13 (0.94–1.35)	1.09 (0.91–1.31)
	Medicaid	1.23 (0.96–1.56)	1.18 (0.92–1.51)	1.15 (0.89–1.48)
In-hospital death	None	1.12 (0.79–1.60)	1.07 (0.74–1.54)	1.08 (0.75–1.55)
	Private Insurance	Ref	Ref	Ref
	Medicare	1.61 (1.45–1.78)	1.09 (0.97–1.24)	1.05 (0.93–1.19)
Discharge to Home	Medicaid	0.96 (0.80–1.15)	1.00 (0.83–1.21)	0.98 (0.81–1.19)
	None	1.34 (1.07–1.69)	1.36 (1.07–1.73)	1.36 (1.07–1.73)
	Private Insurance	Ref	Ref	Ref
Discharge to Home	Medicare	0.44 (0.41–0.47)	0.76 (0.70–0.83)	0.78 (0.71–0.85)
	Medicaid	0.87 (0.78–0.98)	0.85 (0.75–0.96)	0.85 (0.75–0.96)
	None	1.67 (1.44–1.94)	1.91 (1.62–2.25)	1.90 (1.61–2.24)

Abbreviations: CI=confidence interval; ICH=intracranial hemorrhage; IAT=intra-arterial treatment; IVT=intravenous treatment.

<sup>a</sup>Patients received IAT only or IVT+IAT.

<sup>\*</sup> Adjusted by age, sex, race, NIHSS score, arrival by ambulance.

<sup>b</sup> Adjusted by age, sex, race, NIHSS score, arrival by ambulance, prior stroke, hypertension, dyslipidemia, coronary artery disease, heart failure, diabetes mellitus, atrial fibrillation, current smoker.