Understanding Stroke Patterns at Piedmont Athens Regional

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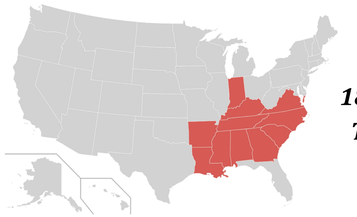
BACKGROUND

- Georgia lies within the "Stroke Belt," a region with high stroke-related death and disability.
- This project, led by UGA's Department of Kinesiology, focuses on ischemic strokes—the most common type.
- Findings aim to guide clinical strategies, improve recruitment, and support future research.



18% Higher Incident Rate Than National Averages

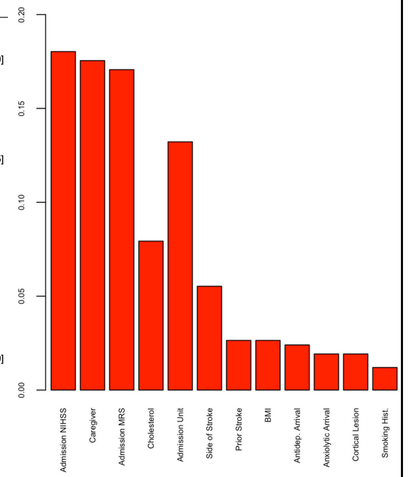
METHODS

- Data Source:
  - 580 stroke patient records from Piedmont Athens Regional (2019–2022), filtered to 438 ischemic stroke cases.
- Data Cleaning:
  - Excluded patients with missing or irrelevant data; standardized variables such as stroke location and race.
  - Outliers: Patients with hospital stays > 60 days (likely unrelated complications)
  - Patients with decimal hospital stays were rounded (e.g., 15.6 → 16)
- Model Evaluation:
  - 10-fold cross-validation to prevent overfitting
  - Confusion matrix used to assess classification accuracy
- Exclusion Criteria:
  - Patients without ischemic strokes (147)
  - Patients with insufficient data (e.g., only ID and stroke type)
- Statistical Methods:
  - **Multiple Linear Regression** to predict hospital stay length
  - **Classification Tree Model** to predict discharge destinations
  - **Robust Variance Estimators** used to address model assumption violations
  - **Stepwise selection** to refine predictive variables

RESULTS

Research Question: How do a stroke patient's pre-existing conditions, lifestyle and demographic factors, caregiver presence, and medication use influence their length of hospital stay and discharge destination?

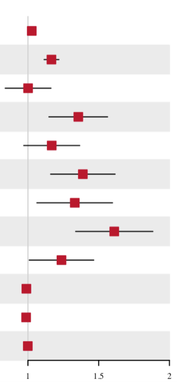
	Overall (N=416)	Admit transfer from ED (N=175)	Observation Unit (N=72)	Stroke Unit (N=46)	ICU (N=33)	Other/NA (N=90)
Age (years)						
Mean (SD)	69.2 (13.1)	68.8 (12.5)	69.6 (13.0)	66.1 (12.4)	65.4 (15.8)	72.8 (13.0)
Median [Min, Max]	69.0 [31.0, 99.0]	68.0 [38.0, 96.0]	71.0 [39.0, 96.0]	64.0 [38.0, 89.0]	66.0 [31.0, 96.0]	73.0 [36.0, 99.0]
Hypertension						
Yes	366 (88.0%)	161 (92.0%)	58 (80.6%)	38 (82.6%)	29 (87.9%)	80 (88.9%)
No	50 (12.0%)	14 (8.0%)	14 (19.4%)	8 (17.4%)	4 (12.1%)	10 (11.1%)
BMI (kg/m^2)						
Mean (SD)	27.9 (6.21)	28.3 (6.28)	27.5 (6.56)	27.8 (5.26)	27.9 (6.21)	27.7 (6.29)
Median [Min, Max]	27.0 [14.0, 59.5]	27.3 [15.0, 51.2]	26.5 [15.7, 57.2]	27.0 [17.9, 39.7]	26.1 [14.0, 40.5]	26.9 [16.5, 59.5]
Missing	11 (2.6%)	0 (0%)	3 (4.2%)	6 (13.0%)	2 (6.1%)	0 (0%)
Admission NIHSS						
Mean (SD)	5.25 (5.99)	4.39 (5.01)	3.75 (4.42)	4.03 (5.11)	10.0 (8.56)	6.81 (6.76)
Median [Min, Max]	3.00 [0, 31.0]	3.00 [0, 25.0]	3.00 [0, 21.0]	3.00 [0, 26.0]	9.00 [0, 31.0]	4.50 [0, 27.0]
Missing	75 (18.0%)	29 (16.6%)	15 (20.8%)	9 (19.6%)	2 (6.1%)	20 (22.2%)
Admission MRS						
Mean (SD)	2.75 (1.64)	2.88 (1.55)	2.55 (1.59)	2.00 (1.79)	2.11 (1.80)	3.39 (1.47)
Median [Min, Max]	3.00 [0, 6.00]	4.00 [0, 5.00]	3.00 [0, 4.00]	1.00 [0, 5.00]	2.00 [0, 4.00]	4.00 [0, 6.00]
Missing	71 (17.1%)	22 (12.6%)	8 (11.1%)	7 (15.2%)	6 (18.2%)	28 (31.1%)
Length of Admission (days)						
Mean (SD)	5.92 (5.63)	5.02 (5.42)	5.58 (6.16)	6.00 (5.26)	7.36 (6.45)	7.36 (5.17)
Median [Min, Max]	4.00 [1.00, 43.0]	3.00 [1.00, 43.0]	3.00 [1.00, 29.0]	5.00 [1.00, 25.0]	6.00 [1.00, 24.0]	6.00 [1.00, 21.0]
Discharge Destination						
Home with no needs	179 (43.0%)	111 (63.4%)	28 (38.9%)	23 (50.0%)	8 (24.2%)	9 (10.0%)
Home health or assisted living	73 (17.5%)	10 (5.7%)	19 (26.4%)	5 (10.9%)	10 (30.3%)	29 (32.2%)
Subacute rehab.	65 (15.6%)	12 (6.9%)	15 (20.8%)	12 (26.1%)	9 (27.3%)	17 (18.9%)
Inpatient or acute rehab.	36 (8.7%)	18 (10.3%)	4 (5.6%)	4 (8.7%)	5 (15.2%)	5 (5.6%)
Hospice/Expiration	35 (8.4%)	2 (1.1%)	2 (2.8%)	1 (2.2%)	1 (3.0%)	29 (32.2%)
Other	13 (3.1%)	7 (4.0%)	4 (5.6%)	1 (2.2%)	0 (0%)	1 (1.1%)
Missing	15 (3.6%)	15 (8.6%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)



$$\log[\text{Length of admission days}] = \beta_0 + \beta_1 \text{AdmissionNIHSS}_i + \beta_2 \text{AdmissionMRS}_i + \beta_3 \text{Side of Stroke-Right}_i + \beta_4 \text{Side of Stroke-Bilateral}_i + \beta_5 \text{Cortical Lesion}_i + \beta_6 \text{AdmissionUnit-Observation}_i + \beta_7 \text{AdmissionUnit-Stroke}_i + \beta_8 \text{AdmissionUnit-ICU}_i + \beta_9 \text{AdmissionUnit-Other}_i + \beta_{10} \text{Prior Stroke}_i + \beta_{11} \text{Diabetes} + \beta_{12} \text{Hypertension} + \beta_{13} \text{IschemicHeartDisease} + \beta_{14} \text{Antidepressants}_i + \beta_{15} \text{Anxiolytics}_i + \beta_{16} \text{SmokingHistory-Former} + \beta_{17} \text{SmokingHistory-Current} + \beta_{18} \text{CaregiverPresence}_i + \beta_{19} \text{Race-Black}_i + \beta_{20} \text{Race-Other}_i + \beta_{21} \text{Age}_i + \beta_{22} \text{Sex-Male}_i + \beta_{23} \text{BMI}_i + \beta_{24} \text{Cholesterol}_i + \epsilon_i$$

Forest Plot of Regression Coefficients of Stepwise Model

Covariates	Est.	95% C.I.	P-Val
Admission NIHSS	1.027	(1.013, 1.042)	< 0.001
Admission MRS	1.166	(1.114, 1.219)	< 0.001
Side of Stroke - Right	1.001	(0.839, 1.163)	0.991
Side of Stroke - Bilateral	1.356	(1.148, 1.563)	0.004
Admission Unit - Observation	1.168	(0.97, 1.366)	0.126
Admission Unit - Stroke	1.388	(1.16, 1.616)	0.005
Admission Unit - ICU	1.331	(1.063, 1.598)	0.037
Admission Unit - Other	1.61	(1.337, 1.883)	< 0.001
Hypertension	1.237	(1.009, 1.465)	0.069
Age	0.989	(0.983, 0.995)	< 0.001
BMI	0.987	(0.975, 0.999)	0.037
Cholesterol	0.999	(0.997, 1)	0.114

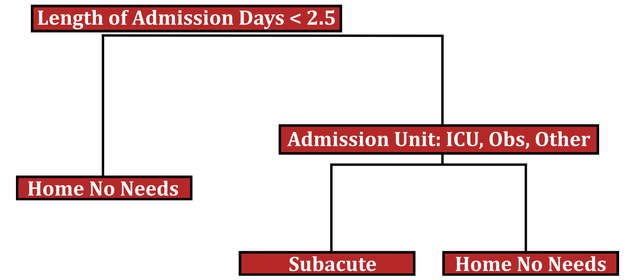


Model based on 100 imputed datasets. Predictors appearing 70% of the time were included (R^2 = 0.24).

RESULTS

Discharge Categories
Home with No Needs | Home Health/ Assisted Living| Subacute Rehab | Inpatient/ Acute Rehab | Hospice/Expiration | Other

Figure 2: Pruned Classification Tree for Discharge Destination



- Data: 382 stroke patients, split into training (305) and test (77) sets
- Variables included: Stroke severity, age, BMI, diabetes, caregiver presence, smoking, etc.
- Initial accuracy: 48.1%
- Pruned tree (by deviance):
  - Accuracy increased to 50.8%
  - Best model (across 100 imputed datasets) reached 57.1% accuracy (higher than random chance)

CONCLUSION

- Stroke severity and admission unit were key predictors of hospital length of stay.
- Younger age and caregiver presence were also associated with longer stays.
- Most patients were discharged home with no needs, which influenced model performance.
- The regression model prioritized interpretability, emphasizing clinical insight over predictive power.
- Findings can inform clinical decision-making and support future stroke research.