Remote Consults to Neurology Inpatients in a Rural Mississippi Hospital

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Talk Overview

- Overview of the Study
- Under The Hood Look At Analysis

Study Background

Rural Hospitals throughout the country face a shortage of specialists, forcing incomplete coverage and costly transfers at many hospitals. Mississippi in particular has a large proportion of rural hospitals, a high chronic disease burden, and an under-insured population. In 2023, South Central Regional Medical Center (SCRMC) in Laurel, MS only had only one neurologist still on-staff.

Study Introduction

During 2023, UMMC's neurology department, with assistance and monitoring from the Center for Telehealth, provided half-time floor neurology service for SCRMC in Laurel, MS. The study included adult patients who received at least one teleneurology consultation during the study period in 2023. A total of 281 eligible patients accounted for 291 hospitalizations involving at least one teleneurology consultation.

Methods - Variables and Population

- **Excess Days of Teleneurology** represents how many more days teleneurology service was on call compared to in-person neurology service during a hospitalization (substitution effect).
- Primary outcomes were hospital **length of stay (LOS)** and **discharge to home**.
- A quasi-random assignment occurred because local neurology coverage rotated during the first half of each month, while teleneurology coverage occurred during the second half.
- In order to have a balanced data set in spite of missing data, modeling was performed on a restricted cohort of hospitalizations that included at least one day with each service on call (105 hospitalizations).

Methods - Models

- Bayesian generalized linear models assessed the association between Excess Days of Teleneurology and each outcome.
- Statistical significance was defined as $\alpha = 0.05$, with $\alpha = 0.10$ considered potentially significant (posterior probability of telehealth inferiority).

Results - Length of Stay

Characteristic	Untransformed Model exp(Beta) (95% CI)	Transformed Model exp(Beta) (95% CI)
Excess Days of Teleneurology	0.99 (0.97 to 1.01)p = .1455	
Log(EDT + 15)		0.76 (0.57 to 1.01)p = .0303**
Log(Age)	1.72 (0.86 to 3.36)	1.81 (0.91 to 3.51)
Medicaid	1.86 (1.22 to 2.83)	1.78 (1.18 to 2.70)
Encephalopathy	1.22 (0.92 to 1.65)	1.22 (0.92 to 1.64)
Male	0.74 (0.56 to 0.98)	0.74 (0.56 to 0.98)
White	0.81 (0.61 to 1.07)	0.81 (0.62 to 1.07)

Abbreviations: ** = .01 < p < .05, CI = Credible Interval, p = Posterior probability of increased LOS

Our best fiting non-linear model showed a significant reduction in LOS due to each increase in Excess Days of Teleneurology. A non-linear model was directionally consistent but not statistically significant.

Results - Discharge to Home

Covariate	**Odds Ratio (95% CI)**
Excess Days of Teleneurology	1.06 (0.98 to 1.15) p =.0711*
Age	0.96 (0.93 to 0.99)
Encephalopathy	0.35 (0.13 to 0.88)

Abbreviation: * = .05 < p < .1, CI = Credible Interval,
p = Posterior probability of decreased odds of discharge to home

Our best fitting model for discharge outcome showed a potentially significant increase in odds of discharge to home due to each increase in Excess Days of Teleneurology.

Conclusion - Significance

Because the schedule was arbitrary relative to pre-existing clinical status and outcomes, we treat exposure to each service as quasi-random. Therefore, we were able to provide more direct evidence of the effectiveness of teleneurology services relative to in-person service than previous studies.

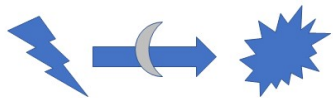
Conclusion - Limitations

- Single rural center over one year, involving one local neurologist and one academic teleneurology team
- Larger sample size might have greater power to detect differences
- Outcomes were limited to LOS and discharge status

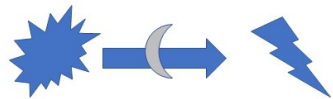
Under The Hood - Arbitrary Assignment

If lightning is known to be correlated with explosions, the explanations could be…

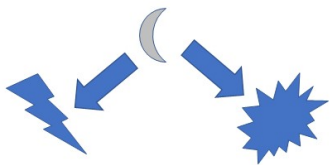
Lightning causes explosions, potentially with mediation (Causation)



Explosions cause lightning, potentially with mediation (Reverse Causation)



Other factors cause both lightning and explosions (Confounding)



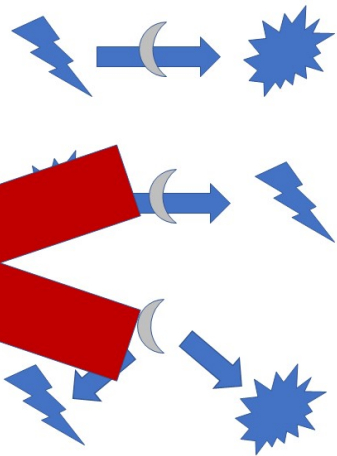
Under The Hood - Arbitrary Assignment 2

Arbitrary Assignment Of Lightning Bolts Eliminates Last Two Possibilities

Lightning causes explosions, potentially with mediation (Causation)

Explosions ca[illegible] lightning, potentially w[illegible] (Reverse Causation)

Other factors [illegible] lightning and explosion[illegible] (Confounding)



Under The Hood - Arbitrary Assignment 3

Covariate	Test	Statistic	df	p-value	95% CI
Stroke	Welch's t-test	0.780	76.8	0.438	(-1.34, 3.06)
Encephalopathy	Welch's t-test	0.173	43.1	0.864	(-2.42, 2.87)
Private Insurance	Welch's t-test	-0.403	17.8	0.692	(-4.15, 2.81)
Dementia	Welch's t-test	1.72	14.2	0.107	(-0.676, 6.2)
Sex	Welch's t-test	-0.847	101	0.399	(-2.99, 1.2)
Medicaid	Welch's t-test	-0.753	14.1	0.464	(-5.62, 2.7)
Epilepsy	Welch's t-test	-1.32	35.7	0.197	(-4.58, 0.976)
Race	Welch's t-test	0.710	96.4	0.479	(-1.36, 2.87)
Age	t-test (Pearson's r)	0.564	103	0.574	(-0.138, 0.245)
COMBINED	Fischer's Chi-Squared	16.4	18.0	0.567	NA

Welch's independent sample t-test for binary variables;
Pearson's linear correlation test for age;
Fischer's pooled hypothesis test

No evidence of significant correlation between Excess Days of Teleneurology and any covariate, or all the covariates pooled.

Under The Hood - REDCap Tables/Variables

Demographics (Patient Level)

- n = 291
- Age
- Sex
- Race
- Zipcode
- Payor

Teleneurology Consults

- n = 605
- Admission date and time
- Admission and Consult ICD-10 Code (first 5) + DRG Code
- Consult date, time, personnel
- Discharge date and time
- Discharge Disposition

Under The Hood - Model Variables

Hospitalizations

- n = 105 (after restriction)
- Excess Days of Teleneurology (integer)
- Length of Stay (count)
- Dischage to Home (t/f)
- Stroke (t/f)
- Encephalopathy (t/f)
- Dementia (t/f)
- Epilepsy (t/f)
- Private Insurance (t/f)
- Medicaid (t/f)
- Sex (m/f)
- Race (b/w)
- Age (count)

No consult data was available for inpatient neurology service. This guided our decision to analyze at the hospital level. We were also forced to analyze only patients who were under the care of both services, because we had no data on patients who received only inpatient neurology care during the study period.

Questions?

Figure: Questions?