Delays in Time to Treatment for Lateral Skull Base Defects

Maggie Mouzourakis[1], Peter Steinwald[2], Anne K. Maxwell[3], Ari Saravia[4], Adam Master[5], Nick Mankowski[5], James E. Saunders[1], Kathryn Noonan[2]

[1]Section of Otolaryngology, Dartmouth Hitchcock Medical Center, Lebanon, New Hampshire
[2]Department of Otolaryngology, Tufts Medical Center, Boston, Massachusetts
[3]Department of Otolaryngology, University of Nebraska Medical Center, Omaha, Nebraska
[4]Louisiana State University School of Medicine
[5]Department of Otolaryngology, Ochsner Health, New Orleans, Louisiana

Background

There is a rise in craniotomies to treat lateral skull base defects (LSBD) associated with elevations in BMI in the US.[1] Diagnosis of LSBD can be challenging, with presentation associated with non-specific symptoms (aural fullness, middle ear fluid, conductive hearing loss). Delays in care are associated with risk of meningitis and temporal epilepsy.

Introduction

Time to diagnosis of LSBD was previously estimated at several years.[2,3] A recent study reported median time of 15.5 months from symptom onset to treatment.[4] While research has shown that MRI imaging may associated with delays in care, there are limited studies specifically examining recent clinical work-up, and social determinants of health affecting treatment of patients presenting with LSBD.[5]

Study Aims

➢ Characterize time to diagnosis and treatment of patients with LSBD
➢ Examine factors associated with delay in diagnosis and treatment of lateral skull base defects

Methods

➢ This is a multicenter cohort study, including 4 US tertiary referral centers
➢ Data was collected from 2000-2022
➢ 127 patients were included
➢ Multivariate regression was used to analyze time to first visit, diagnosis and treatment
➢ Study variables included providers seen, language, insurance status, distance to care, zipcode, area income, area education, diagnostic work-up and treatment
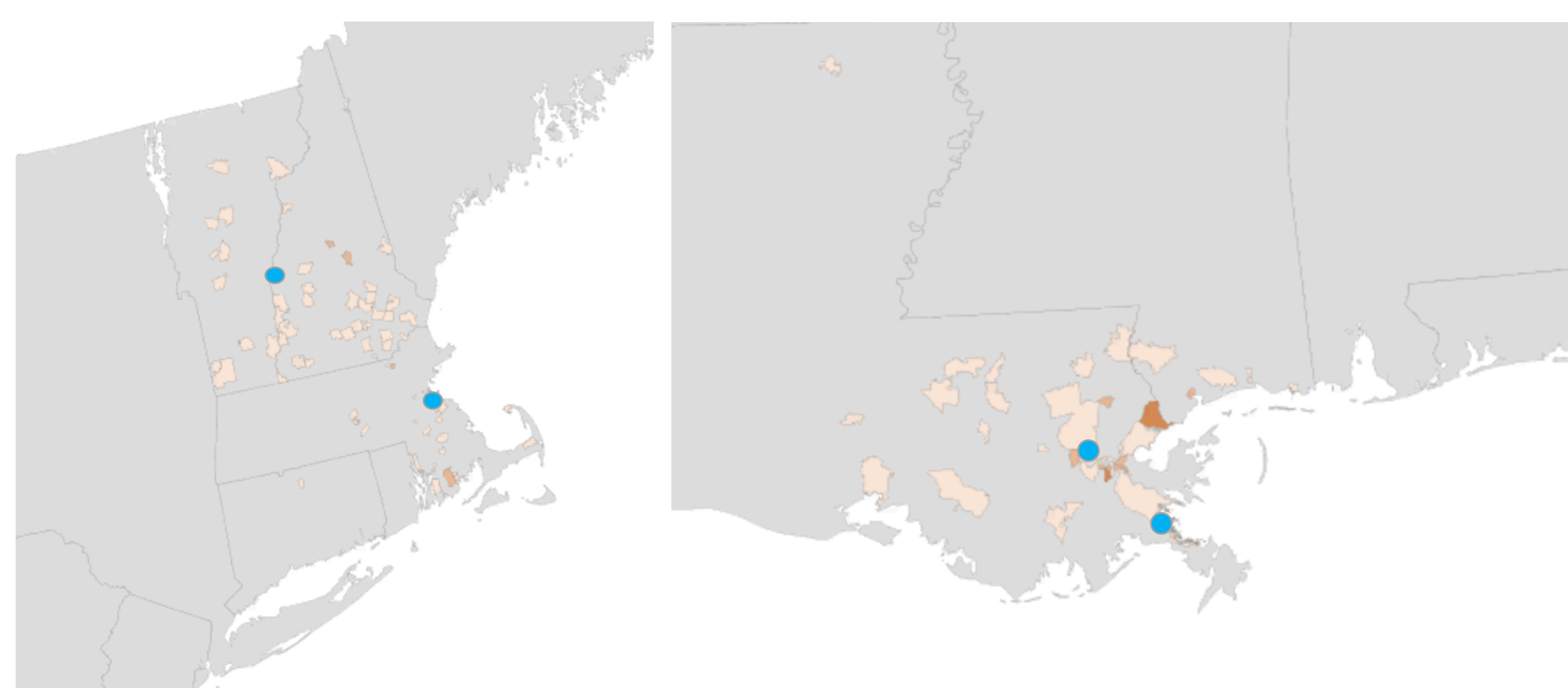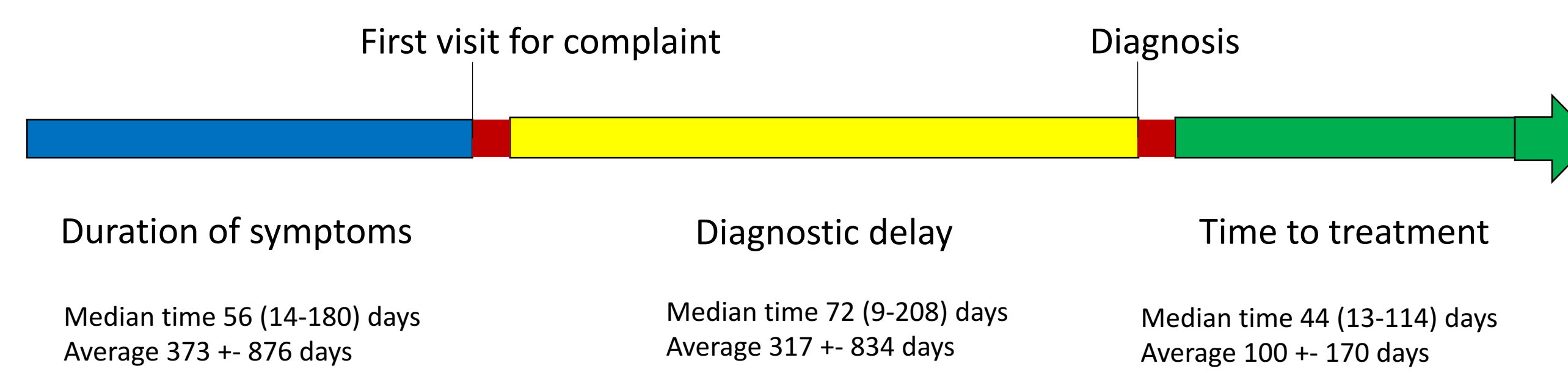
Zipcode Heatmap

Figure 1. The map illustrates zipcodes of where patients included in the study reside. The orange color indicates the zipcode areas, with darker colors indicating more patients residing in those regions. The blue dots mark out the locations of the tertiary neurotology referral centers.

Timeline

First visit for complaint — Diagnosis

Duration of symptoms
Median time 56 (14-180) days
Average 373 +- 876 days

Diagnostic delay
Median time 72 (9-208) days
Average 317 +- 834 days

Time to treatment
Median time 44 (13-114) days
Average 100 +- 170 days

Patient Characteristics

Demographics		Distributions
Factors Analyzed		
Age	Average age	53.9 ± 18.0
	Median	58 (46.75-67)
Sex	Female	72 (56.7%)
No. patients (%)	Male	55 (43.3%)
Race	American Indian/Alaskan	0 (0%)
No. patients (%)	Asian	3 (2.4%)
	Pacific Islander	0 (0%)
	Black/African American	14 (11.0%)
	White	107 (84.3%)
	More than One	0 (0%)
	Unknown	3 (2.4%)
Ethnicity	Hispanic	4 (3.2%)
No. patients (%)	Non-Hispanic	122 (96.1%)
	Unknown	1 (0.8%)
Language	English	121 (95.3%)
No. patients (%)	English as Additional	6 (4.7%)
Insurance	Private	58 (45.7%)
No. patients (%)	Medicaid	22 (17.3%)
	Medicare	35 (27.6%)
	Uninsured	7 (5.5%)
	Unknown	5 (3.9%)
Distance to Care (miles)	Average	62.6± 56.8
	Median	56.2 (23.6-88.0)
Area Family Median Household Income	Average	93,833 ± 19,448
	Median	88,900 (81,900-105,800)
Area Education Attained (%)	Average with More than Highschool Education	61.2% ± 12.4%
BMI (kg/m^2)	Average	32.4±10.4
	Median	30.1(25.99-36)

Table 1. Summary of patient characteristics and demographics. Absolute counts and percentages are displayed, as well as averages with standard deviation and medians with interquartile range where relevant.
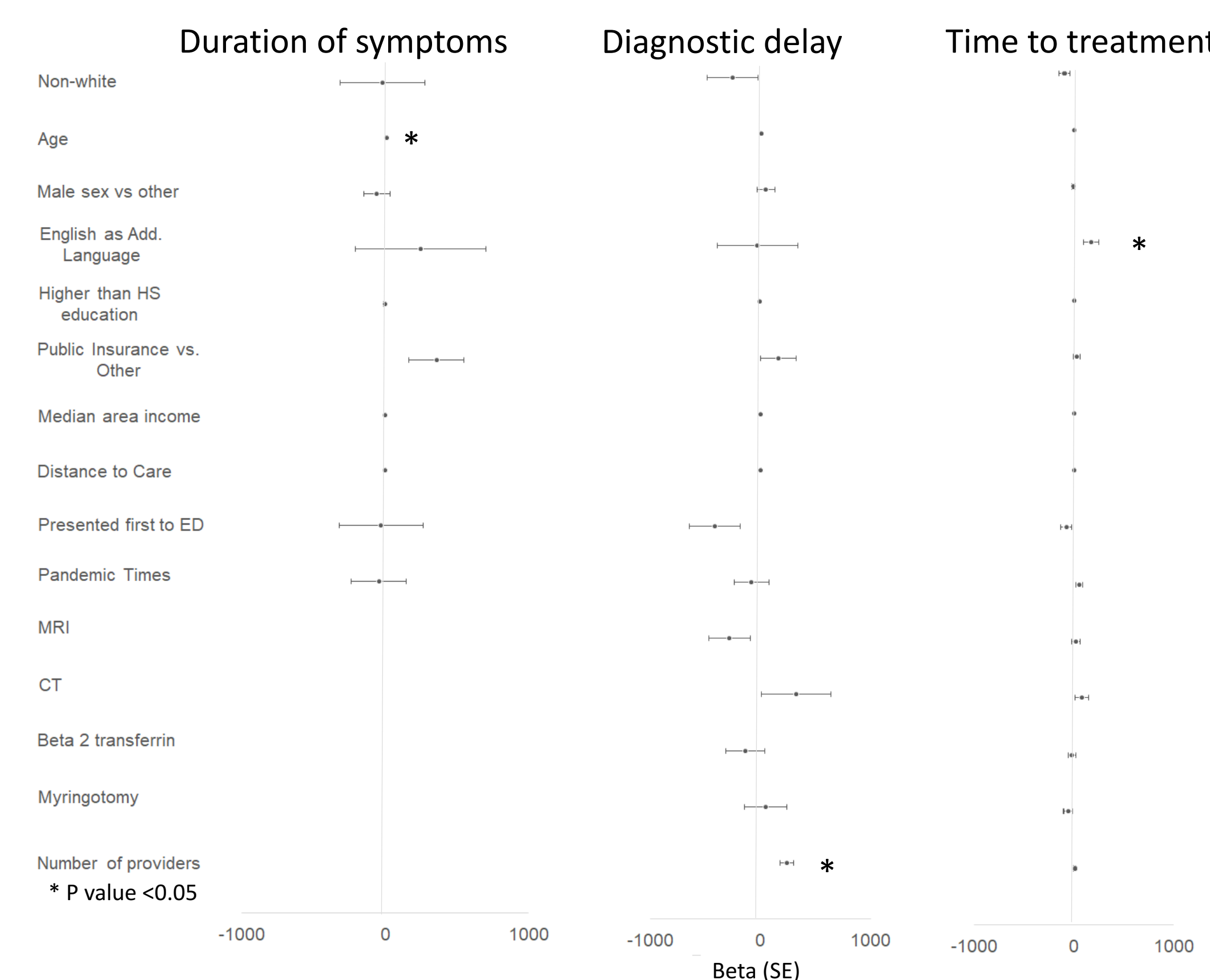
Multivariate Regression

Duration of symptoms — Diagnostic delay — Time to treatment

Non-white
Age *
Male sex vs other
English as Add. Language *
Higher than HS education
Public Insurance vs. Other
Median area income
Distance to Care
Presented first to ED
Pandemic Times
MRI
CT
Beta 2 transferrin
Myringotomy
Number of providers *

* P value <0.05

Beta (SE)

Figure 2. Multivariate linear regressions from the study are displayed, with results for initial symptoms, diagnostic and treatment delay

Area Median Income (PolicyMap)

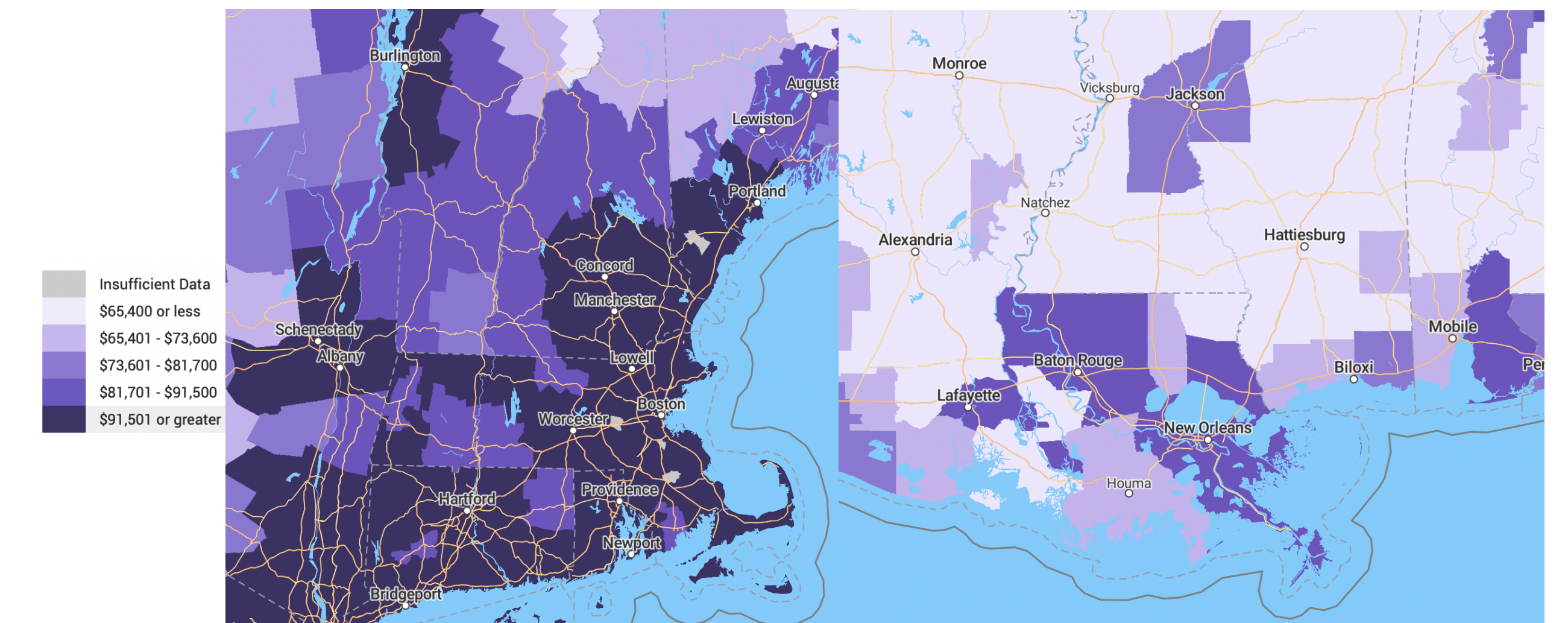|	
Insufficient Data	
$65,400 or less	
$65,401 - $73,600	
$73,601 - $81,700	
$81,701 - $91,500	
$91,501 or greater	

Figure 3. The map includes the New England, New Hampshire and Louisiana catchup area where most of the patients resided. This is a heat map of the area family median income, derived from PolicyMap, used in the analysis of this study.[6] The data is created from the 2022 Department of Housing and Urban Development Survey.

Diagnostic Work-up

Diagnostic Work-up		Distributions
Factors Analyzed		
Number of providers seen	Average	2.4 ± 1.3
	Median	2(2-3)
CT Scan	No	12 (9.4%)
No. patients (%)	Yes	115 (90.6%)
MRI	No	32 (25.2%)
No. patients (%)	Yes	95 (74.8%)
Beta-2 Test	No	79 (62.2%)
No. patients (%)	Yes	48 (37.8%)
Myringotomy	No	85 (66.9%)
No. patients (%)	Yes	42 (33.1%)
Care during COVID19	No	68 (53.5%)
No. patients (%)	Yes	59 (46.5%)
Presented to ED	No	108 (85.7%)
No. patients (%)	Yes	18 (14.3%)

Table 2. Summary of initial diagnostic work-up for individual patients, includes numbers with percentages. Average is displayed with standard deviation, median is displayed with interquartile range.

Discussion

- Patients had a higher than average BMI, reflective of US trends
- Time frame of presentation to diagnosis at 10 months was consistent with prior publications [2-3]
- No. providers seen prior to diagnosis was associated with longer times in oropharyngeal cancer diagnosis as well [7-8]
- Imaging was not associated with delays in care
- Distance was not correlated with delays in care
- Limited English proficiency was associated with delays to treatment, similar to CI research that also shows language as barrier to pursuing CI [9]
- Study is limited as a retrospective review of data, and only captures patients referred to a tertiary medical center and neurotologist.

Conclusions

This is the first study to further analyze barriers to care and time to care for patients with lateral skull base defects. Preliminary data shows that referral patterns and language barriers may influence access to care. Future prospective studies are necessary to better appreciate patient care barriers that may cause delays in treatment.

References

1. Nelson RF, Gantz BJ, Hansen MR. The rising incidence of spontaneous cerebrospinal fluid leaks in the United States and the association with obesity and obstructive sleep apnea. Otol Neurotol. Mar 2015;36(3):476-80. doi:10.1097/mao.0000000000000535
2. Leonetti JP, Marzo S, Anderson D, Origitano T, Vukas DD. Spontaneous transtemporal CSF leakage: a study of 51 cases. Ear, nose & throat journal. 2005;84(11):700-706.
3. Carlson ML, Copeland WR, 3rd, Driscoll CL, et al. Temporal bone encephalocele and cerebrospinal fluid fistula repair utilizing the middle cranial fossa or combined mastoid-middle cranial fossa approach. J Neurosurg. Nov 2013;119(5):1314-22. doi:10.3171/2013.6.Jns13322
4. Curry SD, McCorkle CE, Hatch JL, Casazza GC. An Elusive Diagnosis: Delays in Treatment and Opportunities for Improvement in Temporal Encephalocele and CSF Leak. Otology & Neurotology Open. 2023;3(1):e026.
5. Worrall DM, Pai A, Garneau JC, et al. Temporal Bone Encephaloceles: Utility of Preoperative Imaging. Otolaryngology–Head and Neck Surgery. 2020/09/01 2020;163(3):577-581. doi:10.1177/0194599820918566
6. PolicyMap. 2022. www.policymap.com
7. Karp EE, Yin LX, Moore EJ, et al. Barriers to obtaining a timely diagnosis in human papillomavirus–associated oropharynx cancer. Otolaryngology–Head and Neck Surgery. 2021;165(2):300-308.
8. Karp EE, Yin LX, O'Byrne TJ, et al. Diagnostic Delay in Human Papillomavirus Negative Oropharyngeal Squamous Cell Carcinoma. https://doi.org/10.1002/lary.30307. The Laryngoscope. 2022/07/19 2022;n/a(n/a)doi:https://doi.org/10.1002/lary.30307
9. Tolisano AM, Schauwecker N, Baumgart B, et al. Identifying Disadvantaged Groups for Cochlear Implantation: Demographics from a Large Cochlear Implant Program. Ann Otol Rhinol Laryngol. Apr 2020;129(4):347-354. doi:10.1177/0003489419888232

Contact

Maggie Mouzourakis, MD
Dartmouth-Hitchcock
Section of Otolaryngology
Maggie.m.mouzourakis@hitchcock.org