Understanding Modern Facial Paralysis: Insights from the Largest USA Database

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Introduction

Facial paralysis represents a clinical phenotype with a broad differential diagnosis. Although Bell's palsy remains the most recognized cause, facial weakness may also result from cerebrovascular disease, infection, trauma, congenital disorders, otologic disease, autoimmune conditions, and benign or malignant neoplasms.[1, 2] These less common etiologies require substantially different diagnostic evaluations and treatment, meriting further exploration.

Much of the existing literature on facial palsy is derived from single institutions, disease-specific registries, or narrowly defined populations. Consequently, the demographic and socioeconomic context surrounding facial paralysis remains incompletely characterized, especially at a national scale. Large electronic health record networks provide an opportunity to examine uncommon diagnoses alongside more prevalent causes to incorporate critical social metrics such as the Social Vulnerability and Area Deprivation Indices.

Objective

To describe the contemporary spectrum of facial paralysis in a large national electronic health record database and explore differences in age, sex, social vulnerability, and neighborhood deprivation in selected diagnostic groups.

Methods

We conducted a retrospective descriptive analysis using aggregate data from Epic Cosmos, a national electronic health record network.[3] The study included patients with facial paralysis diagnosed between January 1, 2015 – 2025.

Selected diagnostic groups included Bell's palsy, stroke, varicella zoster, trauma, congenital disorders, acoustic neuroma, benign tumors, head and neck cancer, Lyme disease, autoimmune disease, infectious disease, and otologic conditions. Demographic variables included age, sex, race, and payer type. Neighborhood-level context was assessed using the Social Vulnerability Index and Area Deprivation Index.

Social Vulnerability Index (SVI): A CDC developed, place-based measure that uses USA Census variables to estimate a community's vulnerability to external stressors. It incorporates information on education, income, household characteristics, racial and ethnic minority status, housing, and transportation. Higher SVI quartiles indicate greater vulnerability.[4]

Area Deprivation Index (ADI): A neighborhood-level measure of socioeconomic disadvantage also derived from USA Census data. It incorporates income, education, employment, and housing quality. High ADI deciles indicates greater neighborhood deprivation.[5]

Counts below 10 were suppressed according to database reporting requirements. Because Cosmos provides aggregate rather than patient-level data, patients could not be deduplicated across etiologic groups.

Categorical distributions were summarized using counts and percentages. Percentages for SVI and ADI used patients with available index data as the denominator. Exploratory Pearson chi-square tests evaluated differences across nine etiologic groups. Cramér's V quantified association magnitude.

Results

The largest available query counts occurred among patients with stroke-associated facial paralysis (1,118,889), Bell's palsy (756,243), and other or unknown etiologies (688,797). Additional prominent groups included head and neck cancer (173,464), varicella zoster (116,076), congenital disorders (65,002), and benign tumors (51,169).

The dataset also captured clinically important but rare subgroups, including:

- Acute otitis media or mastoiditis: 112,851
- Nonsyndromic congenital facial paralysis: 60,200
- Meningioma: 38,350
- Multiple sclerosis: 37,357
- Temporal bone fracture: 11,688
- Ramsay Hunt syndrome: 9,759
- Parotid tumor: 9,054
- Zoster sine herpete: 67

Sex distribution differed across etiologic groups (Figure 1). The overall difference was statistically significant, although the association was small: $\chi^2(8) = 16, 234$; $P < 0.001$, $V = 0.083$. Age profiles also differed by diagnostic group, though no statistical analysis was performed due to patient's being able to move between age categories during the study period (Figure 1).

SVI and ADI data was available for ~ 50% of patients. SVI distributions differed statistically across groups, but the association was small: $\chi^2(24) = 9,711$; $P < 0.001$, $V = 0.050$. Similarly, ADI distributions also differed statistically, although the effect size was even smaller: $\chi^2(72) = 8,443$; $P < 0.001$, $V = 0.029$.

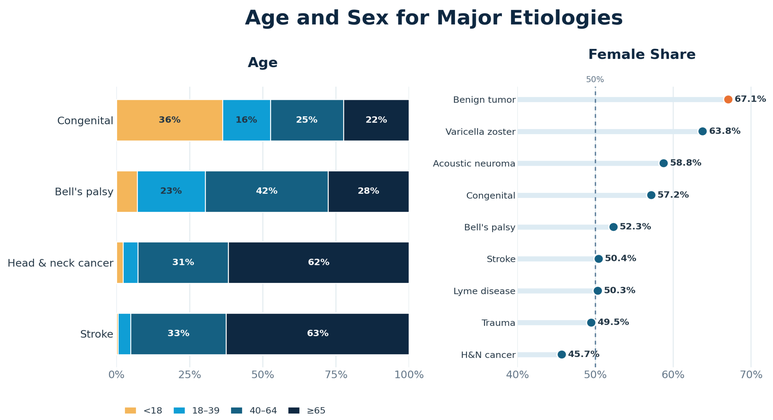


Figure 1: Age composition and sex distribution across the most common etiologic groups from this study.

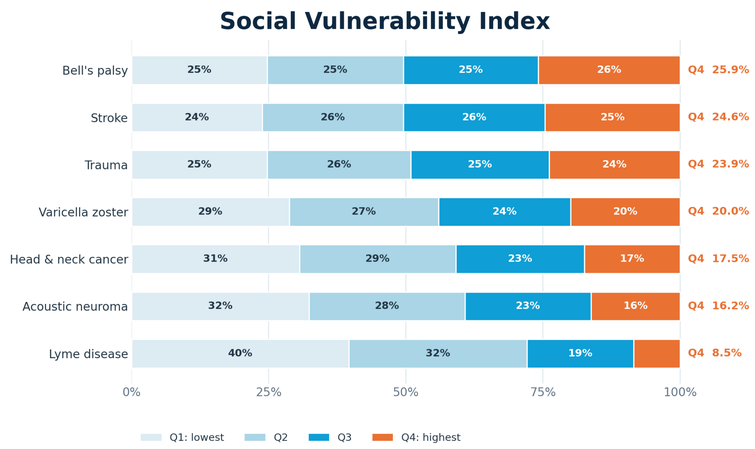


Figure 2: The highest vulnerability quartile is most represented in Bell's palsy and stroke and least in Lyme disease, respectively.

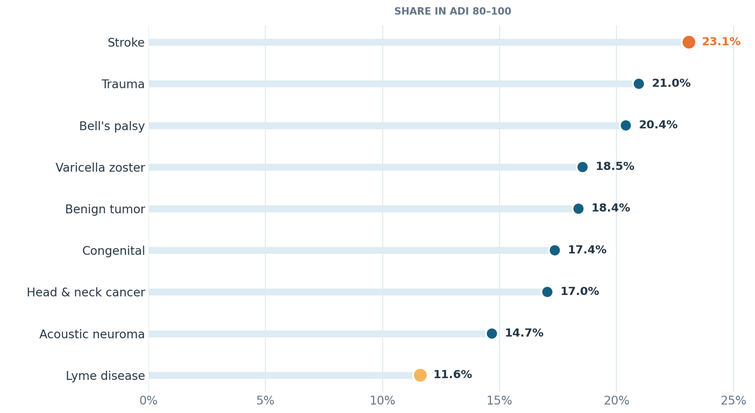


Figure 3: Stroke had the largest share of patents in the highest ADI, while Lyme disease had the smallest.

Conclusions

- Facial paralysis is a heterogeneous condition with distinct etiologic, age, and sex patterns across a large national EHR database.
- Age and sex distributions provide useful descriptive context but should not be interpreted as causal associations or age at disease onset.
- SVI and ADI demonstrated modest differences among etiologies. These indices reflect neighborhood-level conditions rather than individual socioeconomic status.
- Although demographic and socioeconomic differences were statistically detectable, small effect sizes suggest limited practical magnitude.
- These findings provide a national benchmark for understanding the demographic and neighborhood context of facial paralysis and establish a foundation for future investigation.

References

1. Hohman, M.H. and Hadlock, T.A. (2014), Etiology, diagnosis, and management of facial palsy: 2000 patients at a facial nerve center. The Laryngoscope, 124: E283-E293. https://doi.org/10.1002/lary.24542
2. Baugh RF, Basura GJ, Ishii LE, Schwartz SR, Drumheller CM, Burkholder R, Deckard NA, Dawson C, Driscoll C, Gillespie MB, Gurgel RK, Halperin J, Khalid AN, Kumar KA, Micco A, Munsell D, Rosenbaum S, Vaughan W. Clinical practice guideline: Bell's palsy. Otolaryngol Head Neck Surg. 2013 Nov;149(3 Suppl):S1-27. doi: 10.1177/0194599813505967. PMID: 24189771.
3. Tarabichi Y, Frees A, Honeywell S, Huang C, Naidech AM, Moore JH, Kaelber DC. The Cosmos Collaborative: A Vendor-Facilitated Electronic Health Record Data Aggregation Platform. ACI open. 2021 Jan;5(1):e36-e46. doi: 10.1055/s-0041-1731004. PMID: 35071993; PMCID: PMC8775787.
4. Flanagan BE, Hallisey EJ, Adams E, Lavery A. Measuring Community Vulnerability to Natural and Anthropogenic Hazards: The Centers for Disease Control and Prevention's Social Vulnerability Index. J Environ Health. 2018 Jun;80(10):34-36. PMID: 32327766; PMCID: PMC7179070.
5. Kind AJH, Buckingham WR. Making Neighborhood-Disadvantage Metrics Accessible - The Neighborhood Atlas. N Engl J Med. 2018 Jun 28;378(26):2456-2458. doi: 10.1056/NEJMp1802313. PMID: 29949490; PMCID: PMC6051533.

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