Characterizing Small Vessel Disease in Native Hawaiian and other Pacific Islanders with dementia: A retrospective pilot study

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Background

Cerebral small vessel disease (SVD) is composed of several diseases affecting the small arteries, arterioles, venules, and capillaries of the brain leading to cerebral hypoperfusion[1]. SVD is a leading cause for cognitive decline in the elderly, and accounts for about 45% of dementia cases and 25% of ischemic strokes[1]. Features of SVD on magnetic resonance imaging (MRI) include small subcortical infarcts, lacunes, enlarged perivascular spaces, white matter hyperintensities, cerebral microbleeds, and brain atrophy[1,2].

Previous studies have found that SVD is associated with vascular risk factors, including hypertension, diabetes mellitus, and hyperlipidemia[3]. Native Hawaiians and other Pacific Islanders (NHOPI) have also been shown to have higher prevalence of the above vascular risk factors and are diagnosed with dementia at earlier ages compared to their Caucasian and Asian counterparts[4,5]. Therefore, NHOPI patients with dementia may be more implicated by SVD. This study aims to characterize the prevalence and severity of SVD in NHOPI patients with dementia compared to their Caucasian and Asian counterparts.

Objectives

This study aims to: 1) investigate the severity and prevalence of SVD in NHOPI patients with dementia compared to Caucasian and Asian counterparts, 2) elucidate other health and socioeconomic disparities concerning NHOPI patients with dementia that may contribute to SVD.

Methods

A retrospective chart review was performed on patient records using the eClinicalWorks software at Hawaii Pacific Neuroscience (HPN) in Honolulu, HI from January 2016 – July 2023. 2130 patients were identified using an ICD-10 code for a diagnosis of dementia or mild cognitive impairment. Race was determined via self-identity. 37 NHOPI patients were found to fulfill the inclusion criteria of: 1) MMSE score of 23-27 OR MoCA score of 18-23 within 1-year of diagnosis, 2) brain MRI within 1-year of diagnosis, and 3) well-documented medical history. 1 NHOPI patient was excluded due to diagnosis of Moyamoya disease. 36 Caucasian and Asian patients each were then matched to each NHOPI patient based on age (±2), sex, and MMSE or equivalent MoCA score (±1)[6].

Information collected includes demographics such as age, sex, zip-code, level of education, health insurance; social history such as tobacco, alcohol, and illicit drug use; clinical characteristics at time of presentation of memory complaints including symptoms, body-mass index (BMI), co-existing cardiovascular conditions, vascular surgeries, cardiovascular medications, dementia medications, and CHA_2DS_2VASc score; and MRI report findings such as the presence, number, size, and location of small subcortical infarcts, large cortical infarcts, and cerebral hemorrhages. White matter lesions (WML) were graded using the Fazekas scale and Global Cortical Atrophy (GCA) Scale was calculated.

Statistical Analysis:
Demographic variables were assessed through the utilization of frequencies and percentages for categorical variables and means and standard deviations for numerical variables. The demographic characteristics of the participants were compared across three distinct ethnic groups using appropriate statistical methods, including the Chi-square test for categorical variables and ANOVA for numerical variables. To examine the association between NHOPIs, Caucasians, and Asians on key study variables, logistic regression, and proportional odds models were employed, taking into account multiple covariate effects. The outcomes of these analyses were presented using odds ratios (OR) with corresponding 95% confidence intervals (CIs). All statistical analyses were performed using R version 4.3.0, and a P-value less than 0.05 was considered statistically significant.

Results

Table 1: Demographic Information

Characteristic	Overall, N=108[a]	NHOPI, N=36[a]	Caucasian, N=36[a]	Asian, N=36[a]	p-value
Female, No. (%)	72 (66.7%)	24 (66.7%)	24 (66.7%)	24 (66.7%)	>0.999
Age	72.1 (7.2)	72.0 (7.3)	72.1 (7.0)	72.2 (7.5)	0.989
MMSE-score	24.5 (1.0)	24.4 (1.1)	24.6 (0.9)	24.5 (1.0)	0.722
Education					0.333
High school and lower	30 (27.8%)	13 (36.1%)	8 (22.2%)	9 (25.0%)	
Between high school and bachelor's degree	21 (19.4%)	6 (16.7%)	5 (13.9%)	10 (27.8%)	
Bachelor's degree	35 (32.4%)	11 (30.6%)	14 (38.9%)	10 (27.8%)	
Graduate degree and higher	7 (6.5%)	1 (2.8%)	5 (13.9%)	1 (2.8%)	
Unknown	15 (13.9%)	5 (13.9%)	4 (11.1%)	6 (16.7%)	
Health Insurance					0.961
Public	41 (38.0%)	14 (38.9%)	13 (36.1%)	14 (38.9%)	
Private	67 (62.0%)	22 (61.1%)	23 (63.9%)	22 (61.1%)	
BMI	26.9 (5.9)	30.4 (6.0)	25.4 (5.4)	24.9 (4.7)	**<0.001**
Smoking					0.844
Yes	73 (67.6%)	23 (63.9%)	25 (69.4%)	25 (69.4%)	
No	35 (32.4%)	13 (36.1%)	11 (30.6%)	11 (30.6%)	

[a] n (%); Mean (SD)

Figure 1: Prevalence of Cardiovascular Comorbidities

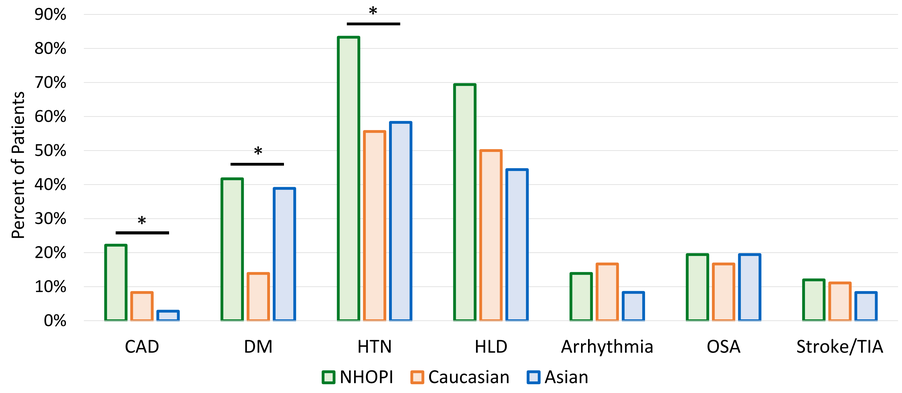

Figure 2: Prevalence of small subcortical infarcts of Caucasians and Asians compared to NHOPI

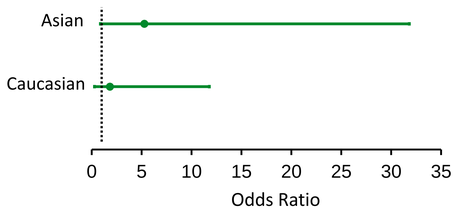

Figure 3: Severity of WML of Caucasians and Asians compared to NHOPI

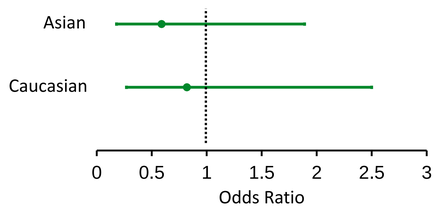

Table 2: Global Cortical Atrophy (GCA) Scale and CHA_2DS_2VASc scores

Scores	Caucasian		Asian	
	Means difference (95% CI)	p-value	Means difference (95% CI)	p-value
GCA Scale	2.27 (-1.33, 5.86)	0.219	-0.89 (-4.59, 2.82)	0.64
CHA_2DS_2VASc	-0.2 (-0.63, 0.23)	0.368	-0.25 (-0.7, 0.2)	0.272

- Of 108 total patients analyzed, most patients were female (66.7%), had a mean age of 72.1 years at time of presentation of memory complaints, and had a mean MMSE-score of 24.5.
- No statistical difference between the 3 groups in education, type of health insurance, and tobacco use.

Results (continued)

- NHOPI patients had a significantly higher BMI (p<0.001) and significantly more NHOPI patients reported history of coronary artery disease (p=0.026), diabetes mellitus (p=0.020), and hypertension (HTN) (p=0.024).
- For symptomatology of dementia, NHOPI patients had significantly higher odds of presenting with attention deficits compared to Caucasian (odds ratio (OR) 0.19, 95% CI 0.05-0.72, p=0.015) and Asian patients (OR 0.16, 95% CI 0.04, 0.71, p=0.016).
- Significantly more NHOPI patients reported usage of antiplatelet medications compared to Caucasians (OR 0.2, 95% CI 0.05-0.72, p=0.014).
- There is a trend of NHOPI having greater severity of WML compared to Caucasians (OR 0.82, 95% CI 0.27-2.5, p=0.731) and Asians (OR 0.59, 95% CI 0.18-1.89, p=0.373) but it was not statistically significant.
- No statistical difference in subcortical infarcts and GCA scale.

Conclusions/Discussion

Our results show that NHOPI patients had higher prevalence of vascular risk factors, namely coronary artery disease, diabetes mellitus, and hypertension, as well as higher BMI. Interestingly, NHOPI patients did not show a higher prevalence of severity of SVD findings. However, this study did show a greater usage of antiplatelet medications in the NHOPI sample, which may be contributing to these findings. However, as NHOPI patients still show differences in symptomatology of dementia, more research is needed to elucidate the presentation of SVD and dementia in NHOPI patients.

Several limitations exist in this study. The small sample size may not represent the whole population. In addition, MRI scans were read by various radiologists, and differences in how findings were reported may skew results.

Future Directions

Due to the small sample size of this study, several factors could not yield meaningful analysis, such as the size, location, and number of SVD findings, and prevalence of cortical strokes and cerebral microbleeds. In the future, the sample size of this study can be expanded by including patients diagnosed with dementia before 2016 and including patients from other health systems.

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Disclosure/Correspondence

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Use of Optimal Treatment Modalities for Spasticity and Stiffness in Post-Stroke and Cerebral Palsy Patients in Native Hawaiian Pacific Islanders (NHPI) and Underserved Populations in Hawaii

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Background

Spasticity is a well documented sequelae following a cerebrovascular accident (CVA) and is often present in conjunction with other neurological conditions such as Cerebral Palsy (CP). Spasticity presents as hypertonicity following extended contracture in addition to the absence of control in the affected region.

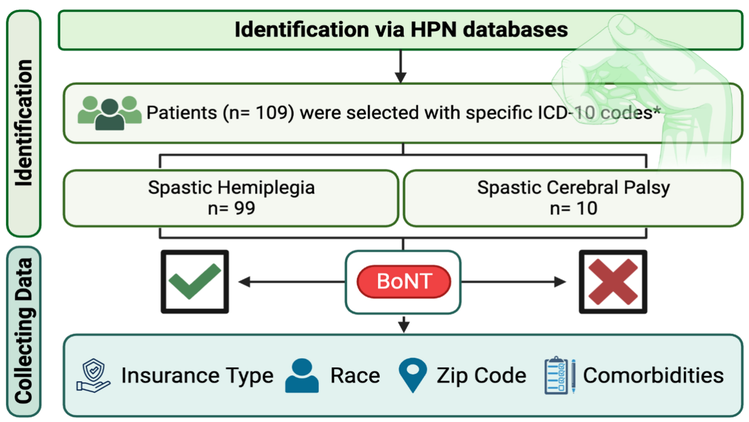
Stroke is the leading cause of disability in both the United States and Hawai'i, with much of the disability resulting from spasticity. Relevant literature approximates that ~25% of stroke victims will suffer from spasticity.[1] Native Hawaiians and Other Pacific Islanders (NHPI) constitute ~11% of the population of Hawai'i.[2] Native Hawaiians are nearly four times more likely to suffer from a stroke as compared to their Non-hispanic White counterparts.[3]

There is a robust array of literature that has found Botulinum Toxin A (Botox) to be an effective treatment option for those affected by spasticity. However, the treatment is expensive, according to the data provided by Hawaii Pacific Neuroscience, the average out-of-pocket cost for uninsured patients is $2,000. For those with insurance, this drops to an average of $250 per treatment. Given that, it is reasonable to conclude that the financial burden may be a prohibitive factor against treatment. This study seeks to investigate any possible correlations between demographic statistics (race, insurance type, and income based on zip code) and treatment (or lack thereof) with Botox for spasticity.

Objectives

- **To determine the extent to which the treatment gap in Post-Stroke/Cerebral Palsy spasticity is related to any socioeconomic factors**

Methods



- Statistical Analysis was performed using a Wilcoxon rank sum test, Pearson's Chi-squared test, and Fisher's exact test.
- Data was collected on 109 patients with the ICD-10 codes for hemiplegia (G81.11, G81.12, G81.13, G81.14), spastic cerebral palsy (G80.0, G80.1, G80.2), and sequelae of cerebral infarction (I69)

Results

Demographic Characteristic	Overall n=109[1]	Recommended Injection: No n=61 (56%)[1]	Recommended Injection: Yes n=48 (44%)[1]	p Value[2]
Sex				0.6
Female	56 (51.4%)	30 (49.2%)	26 (54.2%)	
Male	53 (48.6%)	31 (50.8%)	22 (45.8%)	
Race/Ethnicity				0.3
White	26 (24.1%)	11 (18.3%)	15 (31.3%)	
NHPI	33 (30.6%)	17 (28.3%)	16 (33.3%)	
Asian	41 (38.0%)	27 (45.0%)	14 (29.2%)	
Other	8 (7.4%)	5 (8.3%)	3 (6.3%)	
Unknown	1	1	0	
Insurance Type				>0.9
Public	69 (63.3%)	39 (63.9%)	30 (62.5%)	
Private	38 (34.9%)	21 (34.4%)	17 (35.4%)	
Other	2 (1.8%)	1 (1.6%)	1 (2.1%)	
Tobacco Use				0.6
Yes	20 (18.3%)	10 (16.4%)	10 (20.8%)	
Resident Area				0.7
Central Honolulu	12 (11.0%)	9 (14.8%)	3 (6.3%)	
East Honolulu	7 (6.4%)	5 (8.2%)	2 (4.2%)	
Ewa	7 (6.4%)	5 (8.2%)	2 (4.2%)	
Kaneohe/Kailua	36 (33.0%)	17 (27.9%)	19 (39.6%)	
Pearl City/Aiea	10 (9.2%)	6 (9.8%)	4 (8.3%)	
North Shore	13 (11.9%)	8 (13.1%)	5 (10.4%)	
West Honolulu	17 (15.6%)	8 (13.1%)	9 (18.8%)	
Waianae	4 (3.7%)	2 (3.3%)	2 (4.2%)	
Neighbor Island	3 (2.8%)	1 (1.6%)	2 (4.2%)	

[1] n(%) ; [2] Pearson's Chi-squared test; Fisher's exact test; Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

- 48 patients (44%) of the 109 patients received recommended injection treatments for spasticity
- There were no statistically significant differences between patients who did and did not receive injection treatments based on demographic factors like sex (p-value = 0.6), race (p-value = 0.3), insurance types (p-value > 0.9), or residential area (p-value = 0.7)
- There were also no statistically significant differences between patients who did and did not receive injection treatments with neurologic comorbidities (p-value = 0.3), or mood disorders (p-value = 0.6)

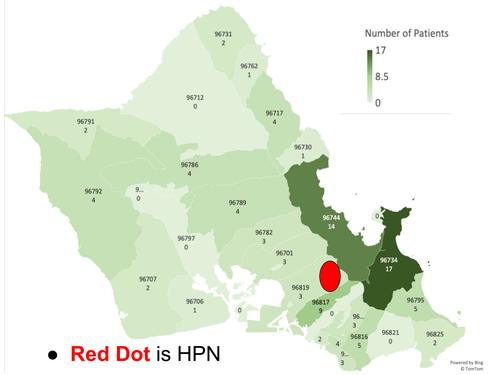
Characteristic	Overall n=109[1]	Recommended Injection: No n=61 (56%)[1]	Recommended Injection: Yes n=48 (44%)[1]	p Value[2]
Disease Type				0.13
Spasticity	56 (51%)	35 (57%)	21 (44%)	
Spasticity/CP	10 (9.2%)	7 (11%)	3 (6.3%)	
Spasticity/ Post-stroke	43 (39%)	19 (31%)	24 (50%)	

[1] n (%) ; [2] Fisher's exact test

Neurologic Comorbidity Characteristic	Overall n=109[1]	Recommended Injection: No n=61 (56%)[1]	Recommended Injection: Yes n=48 (44%)[1]	p Value[2]
Number of Recorded Neurologic Conditions				0.3
0	52 (47.7)%	27 (44.3%)	25 (52.1%)	
1	47 (43.1%)	26 (42.6%)	21 (43.8%)	
>=2	10 (9.2%)	8 (13.1%)	2 (4.2%)	
Mood Disorders	25 (22.9%)	15 (24.6%)	10 (20.8%)	0.6
Other Neurologic Conditions	42 (38.5%)	27 (44.3%)	15 (31.3%)	0.2

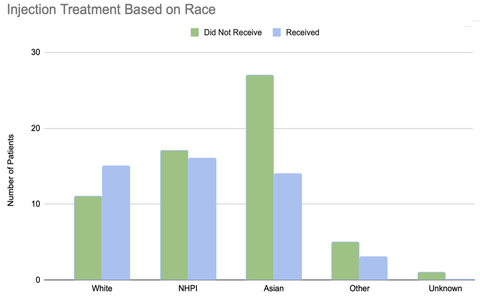
[1] n (%); [2] Fisher's exact test; Pearson's Chi-squared test

Number of Patients in Oahu based on Zip Code

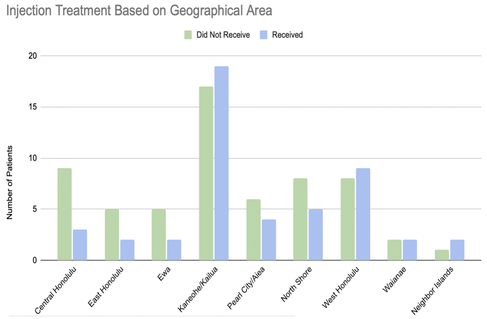


- **Red Dot** is HPN

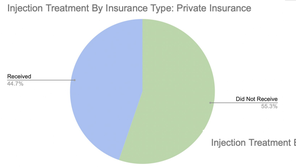
Injection Treatment Based on Race



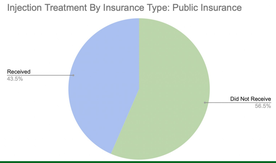
Injection Treatment Based on Geographical Area



Injection Treatment By Insurance Type: Private Insurance



Injection Treatment By Insurance Type: Public Insurance



Conclusions/Discussion

This study aimed to look at underrepresented populations and whether there was a significant difference in treatment options in severe neurological conditions such as spasticity.
A Q&A was made from the findings:

Q: Are there disparities between individuals who received injection treatments based on race or insurance?
A: There was **no statistically significant difference (p-value = 0.13)** between patients of different races who received botox treatment across all disease types. There was also **no statistically significant difference (p-value > 0.9)** between different insurance types (public vs. private insurances).

Q: What is the significance of the lack of disparities between individuals who received injection treatments?
A: The existence of health disparities based on race and socioeconomic status have been well documented. Studies have shown that from 2003 to 2006 the additional medical costs generated by health inequities in the United States totaled **$1.24 trillion.** Elimination of health disparities among racial/ethnic minorities would have reduced these costs by **$229.4 billion**.[4] The lack of statistical significance in our data set shows that efforts to eliminate racial/ethnic disparities are effective at improving access to healthcare, contrary to what the literature may suggest.

Limitations of the study included: small sample size (n = 109), single-center study, and the limitations associated with a retrospective chart review

Future Directions

The prevalence of stroke is rapidly increasing in Hawai'i, with 3,590 reported strokes in 2019. A future direction for this project is to examine the rates of post-stroke spasticity treatments throughout the state. Following the treatment of a wide variety of patients will help improve our understanding of the factors affecting injection treatment in Hawai'i, specifically as it relates to socioeconomic factors.

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Disclosure/Correspondence

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Sub-Investigators: Jason Chang, MD, Jason Viereck, MD, PhD

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Analyzing the Accuracy of Electromyography Findings when Magnetic Resonance Imaging is Positive for Brachial Plexopathy

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Background

The brachial plexus is a network of mixed nerves responsible for both motor and sensory innervation to the upper extremities. An injury to the brachial plexus may be caused by stretching, compression, or, most commonly, ripping of these nerves resulting in severe sensory and motor deficits. The prevalence of brachial plexopathies each year remains unknown as the mechanisms of injury are multifarious; however, the number appears to be increasing each year.

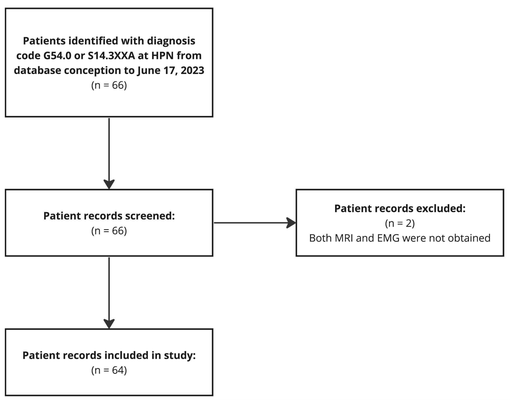
Both magnetic resonance imaging (MRI) and electrodiagnostics tools including electromyography (EMG) are used to assess and diagnose brachial plexopathies. Current literature assesses the complementary value of MRI and EMG as diagnostic tools for brachial plexus injuries in children and neonates; however, there is limited research on the correlation of EMG with MRI for brachial plexus injuries in adults. The degree of agreement between these two tools in adult brachial plexus injuries is, thus, not well established. By assessing the concordance of EMG and MRI with diagnosing adult brachial plexopathies, our study aims to suggest recommendations on the complementary use of these tools alongside clinical assessment.

Objectives

- To investigate the concordance of MRI and EMG findings in adult patients with the diagnosis code for brachial plexus injuries

Methods

- Retrospective chart review of adult patients at Hawaii Pacific Neuroscience (HPN) with the diagnosis code G54.0 or S14.3XXA for brachial plexus injuries from database conception to June 17, 2023
- Data collected from patients included demographics, risk factors, physical exam findings, symptoms, MRI findings, and EMG findings
- Demographics included age, sex, and ethnicity
- Risk factors included Diabetes Mellitus and obesity (body mass index)
- Physical exam findings included weakness, atrophy, and contractures
- Symptoms included pain, weakness, paresthesias, spasms, numbness, lightheadedness/dizziness/trouble balancing, anxiety/depression, headaches, and others
- MRI and EMG were either obtained or not obtained and deem positive or negative if a brachial plexopathy was present
- Pearson's Chi-squared tests and Fisher's exact tests were used to determine if there were any associations between EMG and MRI positive and negative outcomes and patient demographics and clinical characteristics
- Wilcoxon rank sum test was used to assess for associations between continuous variables such as age and body mass index (BMI) with EMG and MRI outcomes
- Overall percentage agreement was determined between EMG findings and MRI impressions as a way to measure inter-rater reliability between the two tests
- P values <0.05 were considered statistically significant. Statistical analyses were performed using version 4.2.0 of R software (R Core Team, 2022)



Results

Table 1: Summary of Data

Characteristic	N = 64
Patient Age	49 (16.8)
Sex	
Male	36 (56.3%)
Female	28 (43.8%)
Ethnicity	
Asian	7 (13.7%)
Black or African American and Other Races	2 (3.9%)
Native Hawaiian and Pacific Islander (NHPI)	14 (27.5%)
White	28 (54.9%)
(Missing)	13
Hispanic or Non-Hispanic	
Non-Hispanic	14 (21.9%)
Hispanic	5 (7.8%)
Did not specify	45 (70.3%)
Risk Factor: Diabetes	12 (18.8%)
Risk Factor: BMI	27 (5.8)
Physical Exam Findings: Weakness	41 (64.1%)
Atrophy	16 (25.0%)
Contractures	6 (9.4%)
Patient Symptoms: Pain	51 (79.7%)
Weakness	42 (65.6%)
Paresthesias	49 (76.6%)
Spasms	2 (3.1%)
Numbness	19 (29.7%)
Lightheadedness, Dizziness, Trouble Balancing	12 (18.8%)
Anxiety or Depression	11 (17.2%)
Headaches	2 (3.1%)
Other Patient Symptoms	3 (4.7%)
Obtained MRI	42 (65.6%)
MRI Impression	
Negative	58 (90.6%)
Positive	6 (9.4%)
Obtained EMG	52 (81.3%)
EMG Findings	
Negative	46 (71.9%)
Positive	18 (28.1%)
Agreement between EMG and MRI Findings	
AGREE	48 (75.0%)
DISAGREE	16 (25.0%)

Mean (SD); n (%)

Table 2a: Summary of Data by MRI Outcome

Characteristic	Overall, N = 64	Negative, N = 58	Positive, N = 6	p-value
Patient Age	49 (16.8)	49 (17.1)	48 (14.6)	0.85
Sex				0.69
Male	36 (100.0%)	32 (88.9%)	4 (11.1%)	
Female	28 (100.0%)	26 (92.9%)	2 (7.1%)	
Ethnicity				0.33
Asian	7 (100.0%)	7 (100.0%)	0 (0.0%)	
Black or African American and Other Races	2 (100.0%)	2 (100.0%)	0 (0.0%)	
Native Hawaiian and Pacific Islander (NHPI)	14 (100.0%)	12 (85.7%)	2 (14.3%)	
White	28 (100.0%)	27 (96.4%)	1 (3.6%)	
(Data Not Available)	13	10	3	
Hispanic or Non-Hispanic				0.26
Non-Hispanic	14 (100.0%)	14 (100.0%)	0 (0.0%)	
Hispanic	5 (100.0%)	4 (80.0%)	1 (20.0%)	
Did not specify	45 (100.0%)	40 (88.9%)	5 (11.1%)	
Risk Factor: Diabetes	12 (100.0%)	12 (100.0%)	0 (0.0%)	0.58
Risk Factor: BMI	27 (5.8)	27 (5.9)	28 (4.7)	0.56
Physical Exam Findings: Weakness	41 (100.0%)	36 (87.8%)	5 (12.2%)	0.41
Atrophy	16 (100.0%)	13 (81.3%)	3 (18.8%)	0.16
Contractures	6 (100.0%)	6 (100.0%)	0 (0.0%)	>0.99
Patient Symptoms: Pain	51 (100.0%)	48 (94.1%)	3 (5.9%)	0.092
Weakness	42 (100.0%)	37 (88.1%)	5 (11.9%)	0.66
Paresthesias	49 (100.0%)	45 (91.8%)	4 (8.2%)	0.62
Spasms	2 (100.0%)	2 (100.0%)	0 (0.0%)	>0.99
Numbness	19 (100.0%)	19 (100.0%)	0 (0.0%)	0.17
Lightheadedness, Dizziness, Trouble Balancing	12 (100.0%)	11 (91.7%)	1 (8.3%)	>0.99
Anxiety or Depression	11 (100.0%)	8 (72.7%)	3 (27.3%)	0.058
Headaches	2 (100.0%)	2 (100.0%)	0 (0.0%)	>0.99
Other Patient Symptoms	3 (100.0%)	3 (100.0%)	0 (0.0%)	>0.99
Obtained MRI	42 (100.0%)	36 (85.7%)	6 (14.3%)	0.086
Obtained EMG	52 (100.0%)	47 (90.4%)	5 (9.6%)	>0.99
EMG Findings				0.048
Negative	46 (100.0%)	44 (95.7%)	2 (4.3%)	
Positive	18 (100.0%)	14 (77.8%)	4 (22.2%)	

Mean (SD); n (%)
Wilcoxon rank sum test; Fisher's exact test

Table 2b: Summary of Data by EMG Outcome

Characteristic	Overall, N = 64	Negative, N = 46	Positive, N = 18	p-value
Patient Age	49 (16.8)	49 (16.9)	47 (16.9)	0.62
Sex				0.006
Male	36 (100.0%)	21 (58.3%)	15 (41.7%)	
Female	28 (100.0%)	25 (89.3%)	3 (10.7%)	
Ethnicity				0.68
Asian	7 (100.0%)	6 (85.7%)	1 (14.3%)	
Black or African American and Other Races	2 (100.0%)	1 (50.0%)	1 (50.0%)	
Native Hawaiian and Pacific Islander (NHPI)	14 (100.0%)	10 (71.4%)	4 (28.6%)	
White	28 (100.0%)	22 (78.6%)	6 (21.4%)	
(Data Not Available)	13	7	6	
Hispanic or Non-Hispanic				0.17
Non-Hispanic	14 (100.0%)	12 (85.7%)	2 (14.3%)	
Hispanic	5 (100.0%)	2 (40.0%)	3 (60.0%)	
Did not specify	45 (100.0%)	32 (71.1%)	13 (28.9%)	
Risk Factor: Diabetes	12 (100.0%)	9 (75.0%)	3 (25.0%)	>0.99
Risk Factor: BMI	27 (5.8)	26 (5.8)	29 (5.4)	0.042
Physical Exam Findings: Weakness	41 (100.0%)	27 (65.9%)	14 (34.1%)	0.15
Atrophy	16 (100.0%)	11 (68.8%)	5 (31.3%)	0.76
Contractures	6 (100.0%)	4 (66.7%)	2 (33.3%)	>0.99
Patient Symptoms: Pain	51 (100.0%)	38 (74.5%)	13 (25.5%)	0.49
Weakness	42 (100.0%)	28 (66.7%)	14 (33.3%)	0.20
Paresthesias	49 (100.0%)	36 (73.5%)	13 (26.5%)	0.74
Spasms	2 (100.0%)	2 (100.0%)	0 (0.0%)	>0.99
Numbness	19 (100.0%)	15 (78.9%)	4 (21.1%)	0.41
Lightheadedness, Dizziness, Trouble Balancing	12 (100.0%)	10 (83.3%)	2 (16.7%)	0.48
Anxiety or Depression	11 (100.0%)	7 (63.6%)	4 (36.4%)	0.49
Headaches	2 (100.0%)	2 (100.0%)	0 (0.0%)	>0.99
Other Patient Symptoms	3 (100.0%)	2 (66.7%)	1 (33.3%)	>0.99
Obtained MRI	42 (100.0%)	31 (73.8%)	11 (26.2%)	0.63
MRI Impression				0.048
Negative	58 (100.0%)	44 (75.9%)	14 (24.1%)	
Positive	6 (100.0%)	2 (33.3%)	4 (66.7%)	
Obtained EMG	52 (100.0%)	34 (65.4%)	18 (34.6%)	0.014

Mean (SD); n (%)
Wilcoxon rank sum test; Pearson's Chi-squared test; Fisher's exact test

Table 3: Summary of Agreement Between EMG Findings and MRI Findings

	MRI Impression (0=negative, 1=positive)			
	Negative	Positive	Total	p-value[1]
EMG Findings (0=negative, 1=positive)				0.048
Negative	44 (69%)	2 (3.1%)	46 (72%)	
Positive	14 (22%)	4 (6.3%)	18 (28%)	
Total	58 (91%)	6 (9.4%)	64 (100%)	

[1] Fisher's exact test

- The sample population consisted of 64 patients from the HPN database with confirmed brachial plexopathies
- About 56.3% (n=36) of patients were males and 43.8% (n=28) were females
- Majority of patients were White (54.9%, n=28) while 27.5% (n=14) were Native Hawaiian and Pacific Islander (NHPI), 13.7% (n=7) were Asian, and 3.9% (n=2) were Black or African American or Other Races
- Physical exam findings found that 64.1% (n=41) patients experienced weakness and 25.0% (n=16) experienced atrophy
- A few of the more common patient symptoms were pain (79.7% (n=51)), paresthesias (76.6% (n=49)), and numbness (29.7% (n=19)).
- The overall percentage agreement between the EMG findings and MRI impressions was 75.0% (48/64)
- About 6.3% (n=4) patients had a positive EMG finding and a positive MRI impression while 69% (n=44) of patients had a negative EMG finding and a negative MRI impression (p=0.048) (Table 3. Summary of Agreement between EMG Findings and MRI Findings)
- Sex and BMI were found to be significantly associated with EMG findings. 89.3% (n=25) of females had a negative EMG finding while 41.7% (n=15) of males had a positive EMG finding (p=0.006)
- BMI was also higher among patients with a positive EMG finding at an average of 29 compared to patients with a negative EMG finding with an average BMI of 26 (p=0.042)

Discussion

The study analyzed the concordance between EMG and MRI findings among 64 adult patients from the HPN database with confirmed brachial plexopathies. The overall percentage agreement between the EMG findings and MRI impressions was 75.0%. This finding supports prior literature demonstrating a high correlation between EMG and MRI in diagnosing adult brachial plexopathy ($p<0.05$). In fewer cases, the EMG and MRI findings disagreed. 25.0% of cases were positively diagnosed for only one of these tests. Sex and BMI were found to be significantly associated with EMG findings, which could suggest that neural and muscular activity of the brachial plexus differ as a function of sex and BMI.

Given that the sample patient population was small, we cannot necessarily say that EMG can fully replace the gold-standard method of diagnosing adult brachial plexus injuries. However, we can suggest that this study shows that EMG findings have a significant association with MRI impressions among patients with brachial plexus injuries and should be included as a factor in future algorithms or diagnostic programs to determine brachial plexus diagnosis in adults. The study also highlights the importance of considering sex and BMI in the diagnosis of adult brachial plexus injuries.

This study is not without limitations. The small sample size and single center, single provider design limits the generalizability of the data and introduces observation bias, human error, and machine error. Another limitation was the retrospective nature of this study. This study depended on the accurate record-keeping and interpretation of patient charts.

Future Directions

Future studies should include a larger sample size, multiple centers, and multiple diagnosticians to increase the generalizability of the findings and to further assess the concordance of MRI and EMG findings in identifying brachial plexopathies. Additionally, future studies should investigate the use of other electrodiagnostics tools or methods of accurately identifying brachial plexopathies.

Conclusions

The concordance between EMG and MRI findings for diagnosing brachial plexopathies was 75% and found to be statistically significant which supports current literature. Future studies should include data from multiple centers and providers as well as a larger sample size.

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Disclosure/Correspondence

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Exploring Radiculopathy in Underserved Communities: A Focus on AANHPI Populations and Risk Factors

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Background

Radiculopathy (RP) is a debilitating nerve compression condition that can decrease a patient's quality of life. RP occurs as the result of the compression of cervical, thoracic, or lumbar spinal nerve roots by nearby tissue and bones[1]. Herniated discs, spinal stenosis, and degenerative disc disease are amongst etiologies that can result in symptoms of pain, weakness, and numbness manifesting in the nerves/regions affected.[2]

Previous studies have shown a correlation between RP and other comorbidities such as, diabetes, hypertension, hyperlipidemia, and mental disorders. [3] However, theses studies often lack patients of Asian American Native Hawaiian Island Pacific (AANHIP) descent. This study aims to address to paucity of research on RP in AANHPI populations and to identify differences in clinical presentation, comorbidities, and treatment of AANHPI in contrast to other ethnocultural racial groups in Hawaii.

Objectives

1. Identify differences in the clinical presentation and treatment of RP in the AANHPI to other Ethnocultural groups in Hawaii.
2. Identify relating comorbidities to determine risk factors of RP.
3. Identify associated comorbidities in AANHPI population

Methods

This retrospective cohort study utilizes data from a single neurological care center in Hawaii. Adults aged ≥18 years diagnosed with RP between 2016-2023 were identified using ICD10 codes (M51) Patients without electromyography (EMG), magnetic renaissance imaging (MRI), or sufficient demographical data were excluded. Information collected includes:

- socio-demographic characteristics: age, age at diagnosis, sex, race/ethnicity, insurance, resident area, county, weight status, smoking status, alcohol use
- mental health conditions: depression based on PHQ2, history of depression, and other mental health conditions
- medical comorbidity: hypertension, hyperlipidemia, hypercholesterolemia, concussion/traumatic brain injury, other traumatic injuries, diabetes, spondylolisthesis, hyperthyroidism, hypothyroidism, history of cancer

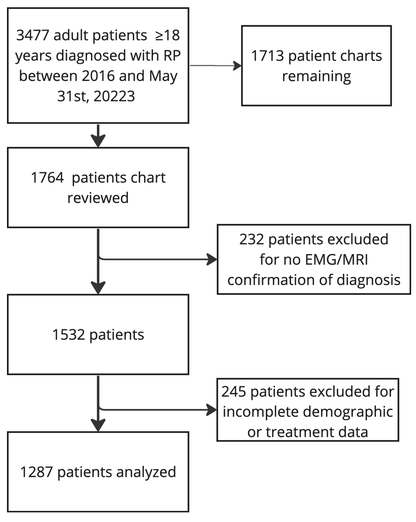

Figure 1: Methodology Schematic

Patients were categorized into five groups for race/ethnicity. Those who self-identified as Native Hawaiian or other Pacific Islanders were categorized as NHPI. Else, those who self-identified as Asian were categorized as Asian. Else, those who self-identified as Black, American Indian, Alaska Native, Hispanic, or other race were categorized as Other. Those who self-identified as White only were categorized as White. For smoking and alcohol use, patients were categorized as "No", "Yes", or "Former smoker/drinker."

Patient characteristics were described in frequency and percentage for categorical variables. For continuous variables, mean and standard deviation or median and interquartile range were used. Bivariate analysis were performed to assess associations with race/ethnicity, age, and sex for patients' characteristics. One-way ANOVA or Kruskal-Wallis rank sum test for continuous variables. To examine differences across groups Fisher's Exact Test or Pearson's Chi-squared test was conducted. A p-value less than 0.05 was considered statistical significance.

Results

Cohort Characteristics

- Of the 1287 patients analyzed, 58% of patients were AANHPI: 28% Asian and 20%NHPI
- F: M ratio of ~3:1 across all ethnicities; F diagnosed younger (<0.001)
- Most RP patients had private insurance (47.5%, p<0.001)

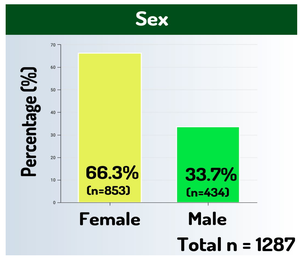

Figure 2: Sex Demographics

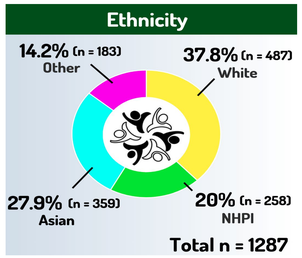

Figure 3: Ethnicity Demographics

Insurance Status

- AANHPI populations were more likely to have public insurance (43.95% vs. 32.2%, p<0.001), while their white counterparts had higher rates of military insurance (24.2% vs. <10%, p<0.001).

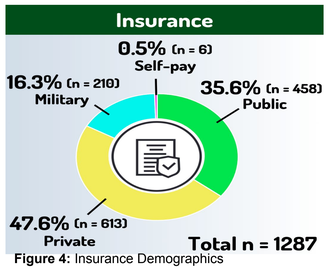

Figure 4: Insurance Demographics

Insurance Status

Type of Insurance	Overall n=1287	White n= 487 (38%)	NHPI n=258 (20%)	Asian n=359 (28%)	Other n=183 (14%)	P-value
Public	458 (35.6%)	157 (32.2%)	114 (44.2%)	132 (36.8%)	55 (30.1%)	<0.001
Private	613 (47.6%)	211 (43.3%)	130 (40.4%)	196 (54.6%)	76 (41.5%)	
Military	210 (16.3%)	118 (24.2%)	12 (4.7%)	29 (8.1%)	51 (27.9%)	
Self-Pay	6 (0.5%)	1 (0.2%)	2 (0.8%)	2 (0.6%)	1 (0.5%)	

Table 1: Insurance Status by Race

Age of Diagnosis

- NHPIs had the youngest age of diagnosis and were diagnosed with RP 1.9 years earlier (p<0.001)
- Asian Americans had the oldest age of diagnosis, on average 3.6 years later than the average (p<0.001)

Age of Diagnosis

Characteristic	Overall n=1287	White n= 487 (38%)	NHPI n=258 (20%)	Asian n=359 (28%)	Other n=183 (14%)	P-value
Age at Diagnosis (SD)	46.8 (13.9)	46.4 (13.7)	31 (26,37)	49.94 (15.2)	44.7 (11.5)	<0.001

Table 2: Age of Diagnosis by Race

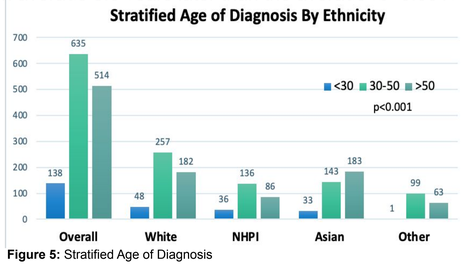

Figure 5: Stratified Age of Diagnosis

Average BMI and Obesity

- NHPI populations had the highest rates of obesity and highest average BMI (<0.001)
- Asians had the lowest average BMI and were the least likely to be obese (p<0.001)

Average BMI

Characteristic	Overall n=1287	White n= 487 (38%)	NHPI n=258 (20%)	Asian n=359 (28%)	Other n=183 (14%)	P-value
BMI (25th, 27th percentile)	36 (24,32)	27 (23,31)	31 (26,37)	26 (23,30)	28 (24,33)	<0.001
Obesity (BMI >30)	458	143(29.4%)	146 (56.6%)	95 (26.5%)	74 (40.04%)	<0.001

Table 3: Average BMI and Weight Status By Race

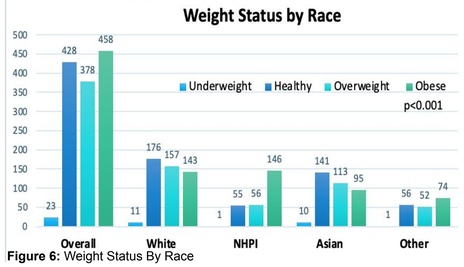

Figure 6: Weight Status By Race

Treatment Differences

- AANHPI populations were less likely to be treated with PT, steroid injections, and surgery (p<0.001)

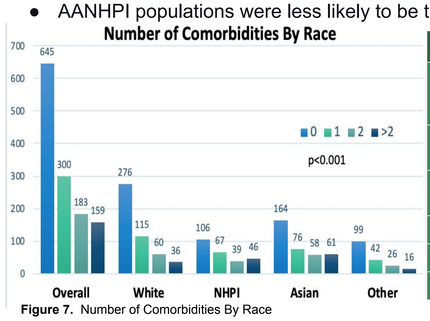

Figure 7. Number of Comorbidities By Race

Treatments

Treatment Types	Overall n=1287	White n= 487 (38%)	NHPI n=258 (20%)	Asian n=359 (28%)	Other n=183 (14%)	P-value
None	248 (19.3%)	94 (19.3%)	37 (14.3%)	82 (22.8%)	48 (26.2%)	0.042
Medications	246 (19.1%)	64 (13.1%)	60 (23.3%)	90 (25.1%)	32 (17.5%)	
Physical Therapy	90 (7.0%)	21 (4.3%)	24 (9.3%)	41 (11.4%)	4 (2.2%)	
Steroid Injections	2 (0.2%)	0 (0.0%)	2 (0.8%)	0 (0%)	0 (0%)	
Surgery	5 (0.4%)	1 (0.2%)	0 (0.0%)	2 (0.6%)	2 (1.1%)	

Table 4: Treatments by Race

Results (continued)

Medical Comorbidities

- AANHPI populations had higher rates of hypertension, hyperlipidemia,hypercholesterolemia, and diabetes and were more likely to have > 2 comorbidities (p<0.001)

Medical Comorbidities

Characteristic	Overall n=1287	White n= 487 (38%)	NHPI n=258 (20%)	Asian n=359 (28%)	Other n=183 (14%)	P-value
Hypertension	405 (31.5%)	111 (22.8%)	101 (39.1%)	145 (40.4%)	48 (26.2%)	<0.001
Hyperlipidemia	246 (19.1%)	64 (13.1%)	60 (23.3%)	90 (25.1%)	32 (17.5%)	<0.001
Hypercholesterolemia	90 (7.0%)	21 (4.3%)	24 (9.3%)	41 (11.4%)	4 (2.2%)	<0.001
Concussion/TBI	64 (5.0%)	24 (4.9%)	15 (5.8%)	11 (3.1%)	14 (7.7%)	0.11
Other Traumatic Injuries	25 (1.9%)	10 (2.1%)	4 (1.6%)	6 (1.7%)	5 (2.7%)	0.8
Diabetes	167 (13%	33 (6.8%)	55 (21.3%)	58 (16.2%)	21 (11.5%)	<0.001
Spondylolisthesis	27 (2.1%)	12 (2.5%)	7 (2.7%)	5 (1.4%)	3 (1.6%)	0.6
History of Cancer	70 (5.4%)	30 (6.2%)	17 (6.6%)	16 (4.5%)	7 (3.85)	0.4
Hyperthyroidism	11 (0.9%)	4 (0.8%)	3 (1.2%)	1 (0.3%)	3 (1.6%)	0.3
Hypothyroidism	90 (7.0%)	43 (8.8%)	14 (5.4%)	21 (5.8%)	12 (6.6%)	0.2

Table 5: Medical Comorbidities by Ethnicity

Conclusions/Discussion

The preliminary results of our study found that AANHPI patients are more likely to be publicly insured, have multiple comorbidities, and have higher rates of hypertension, hyperlipidemia, hypercholesterolemia and diabetes.

Despite having more and higher rates of comorbidities, AANHPI were less likely to receive specialized treatments such as physical therapy, steroid injections or surgery.

Another noteworthy finding was that Asians and NHPI presented with radiculopathy at different ages are diagnosed earlier and have higher rates of obesity compared to all other ethnicities. These findings have important implications for for addressing underlying comorbidities and treatment disparities amongst AANHPI patients. This also provides a unique opportunity for physicians to address these risk factors to prevent the development of RP especially AANHPI populations.

A major limitation of the current results is that it only represents ~50% of the dataset centered around the mean age of RP diagnosis. As more patient data is added, statistically findings may change. Another limitation of this study is its utilization of data from a single spine and neck center leading to possible sampling bias. As >10% of identified patients were excluded due to lack of demographic data or EMG/MRI confirmation, the findings fail to captures these patients.

Future Directions

Future steps in this study include completing the remaining patient data abstractions. Statistical data analysis and associations could not be properly completed due to the missing data. Future studies can also be conducted to evaluate if there are post-treatment outcome disparities amongst the different ethnicities. Additional studies can be undertaken to assess whether implementing preventative interventions addressing associated comorbidities would improve RP treatment outcomes.

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Disclosure/Correspondence

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Investigating The Relationship of Smoking, Sociodemographic factors, and Medical Comorbidities Among Chronic Pain Patients in Hawaii

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Background

Chronic pain, as defined by the International Association for the Study of Pain as pain that persists for longer than 3 months, is a debilitating condition that can negatively impact cognitive performance, physical and social well-being, and overall quality of life.[1] Opioids can be used in the complex management of chronic pain, but due to a 34.5% increase in opioid overdose deaths from 2019 to 2021 in Hawaii,[2] it is important to investigate factors contributing to chronic pain in order to alleviate opioid dependence and prevent addiction.

Tobacco use is the leading cause of preventable death and disease in Hawaii.[3] The relationship between chronic pain and smoking has been well established, but requires further study. Using the Numerical Rating Scale, some studies have found smoking to diminish perceived pain in chronic pain patients while others have found it to exacerbate perceived pain.[4] Therefore, understanding how additional factors, including smoking, can influence chronic pain could provide insight for physicians recommending treatment options.

Objectives

To examine patients characteristics and differences by smoking status among patients with a diagnosis of chronic pain in Hawaii.

Methods

A retrospective chart review was conducted on patient charts at Hawaii Pacific Neuroscience (HPN) in Honolulu, HI. We collected 179 patient records, from January 2000 to May 2023, that had a diagnosis of G89.4 (chronic pain syndrome) and had documented symptoms of related pain for more than 12 weeks by the time of data collection. A total of 4 patients were excluded who did not meet the criteria, thus 175 patients were included.

Patients were categorized as non-smoker, former-smoker, and current-smoker and each group was compared across the different variables. Other variables include demographic characteristics (age, sex, insurance, resident area, island), psychiatric comorbidity (history of depression/major depressive disorder, anxiety/generalized anxiety, PTSD, ADHD/ADD, schizophrenia, bipolar disorder, and other psychiatric conditions), medical comorbidity (somatoform, pain, headache syndrome, spine pain, back pain/dorsalgia, lumbar pain, joint pain, limb pain, and myalgia) and opioid use. The numbers of recorded psychiatric and medical comorbidities were calculated for each patient. Patients' reported ethnicity was collected. Native Hawaiian or Pacific Islander were categorized as NHPI. Those who reported Asian were categorized as Asian. Those who reported Black, Alaska Native, American Indian, Hispanic, and any races other than White were categorized as Other. Those who reported only White were categorized as White. Those who did not specify their race/ethnicity were categorized as Unknown.

The numerical pain rating scale was used to assess the patients' perceived pain severity at the time of diagnosis. The pain scale ranged from 0 to 10 with a score of 0 indicating no pain and a score of 10 indicating the worth pain the patient has ever felt.

Patient characteristics were described in frequency and percentage for categorical variables, and mean and standard deviation or median and interquartile range for continuous variables. Differences in patient characteristics by groups were examined by Chi-square test or Fisher's exact test for categorical variables and Wilcoxon rank sum test or Kruskal-Wallis rank sum test for continuous variables. A p-value less than 0.05 was considered statistical significance.

Results

- There was no statistically significant difference in numerical pain rating scale at time of diagnosis between non-smokers, former smokers, and current smokers.
- Of the chronic pain patients, those who were former or current smokers had a higher proportion of private insurance users and patients who were non-smokers had a higher proportion of public and other insurance users (p = 0.039).
- Furthermore, current and former smokers had a higher proportion of current opioid use documented in their patient charts compared to non-smokers (p = 0.035).
- Of the collected medical comorbidities, only spine pain (M54) related diagnoses had statistical significance when compared between non-smokers, former smokers, current smokers (p = 0.004) and when compared between non-smokers and former/current smokers (p = 0.003).
- Lastly, the number of medical comorbidities statistically differed across the reported ethnicities (p = 0.002).

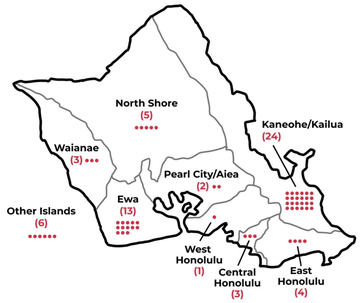


Figure 1: Map of Oahu indicating prevalence of smoking across the island. Each red dot is a patient with chronic pain who is either a former or current smoker. This map shows how pervasive smoking is in certain areas of the island

Characteristic	Overall n=175[1]	Smoking (No=non-smoker, Yes=former smoker/current smoker) No n=114 (65%)[1]	Yes n=61 (35%)[1]	p-value[2]
Age	57 (14.5)	55 (14.5)	59 (14.3)	0.2
Sex				0.3
Male	74 (42.3%)	45 (39.5%)	29 (47.5%)	
Female	101 (57.7%)	69 (60.5%)	32 (52.5%)	
Insurance				**0.039**
Private	37 (21.1%)	18 (15.8%)	19 (31.1%)	
Public	108 (61.7%)	73 (64.0%)	35 (57.4%)	
Other	30 (17.1%)	23 (20.2%)	7 (11.5%)	

Figure 2: Smoking status proportions based on insurance type. More former/current smokers have private insurance and more non-smokers had public and other insurance. Other insurances consist of Tricare, VA and Worker's Compensation.

Characteristic	Overall (n = 175)[1]	Non-Smoker (n = 114, 65%)[1]	Former/current smoker (n = 61, 35%)[1]	p-value[2]
Current opioid use	**81 (47%)**	**46 (41%)**	**35 (57%)**	**0.035**
Previous opioid use	44 (25%)	32 (28%)	12 (20%)	0.2

[1] n (%)
[2] Pearson's Chi-squared test

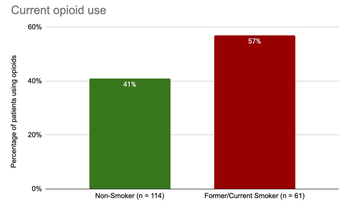
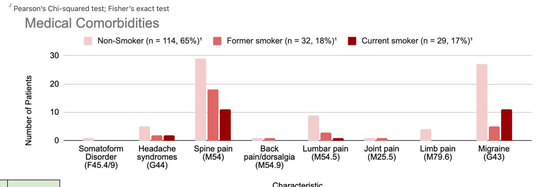


Figure 3: Proportion of patients from those who are non-smokers compared to those that were former or current smokers who had current opioid use documented in the chart.

Characteristic	Overall (n = 175)[1]	Non-Smoker (n = 114, 65%)[1]	Former/current smoker (n = 61, 35%)[1]	p-value[2]
Somatoform Disorder (F45.4/9)	1 (0.6%)	1 (0.9%)	0 (0.0%)	>0.9
Headache syndromes (G44)	9 (5.2%)	5 (4.4%)	4 (6.6%)	0.7
Spine pain (M54)	**58 (33.3%)**	**29 (25.7%)**	**29 (47.5%)**	**0.003**
Back pain/dorsalgia (M54.9)	2 (1.1%)	1 (0.9%)	1 (1.6%)	>0.9
Lumbar pain (M54.5)	13 (7.5%)	9 (8.0%)	4 (6.6%)	>0.9
Joint pain (M25.5)	2 (1.2%)	1 (0.9%)	1 (1.6%)	>0.9
Limb pain (M79.6)	4 (2.3%)	4 (3.6%)	0 (0.0%)	0.3
Migraine (G43)	43 (24.6%)	27 (23.7%)	16 (26.2%)	0.7

[1] n (%)
[2] Pearson's Chi-squared test; Fisher's exact test



Number of recorded medical comorbidities	Overall (n = 175)[1]	White n=53 (30%)[1]	NHPI n=25 (14%)[1]	Asian n=28 (16%)[1]	Other n=25 (14%)[1]	Unknown n=44 (25%)[1]
0	38 (22%)	9 (17%)	0 (0%)	6 (21%)	9 (39%)	14 (33%)
1	55 (32%)	13 (25%)	13 (52%)	14 (50%)	2 (8.7%)	13 (30%)
2	44 (26%)	17 (33%)	7 (28%)	4 (14%)	8 (35%)	8 (19%)
>2	34 (20%)	13 (25%)	5 (20%)	4 (14%)	4 (17%)	8 (19%)
p-value[2] = **0.002**						

[1] n (%)
[2] Fisher's exact test; Pearson's Chi-squared test; Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

Characteristic	Overall n=175	Smoking: Non-smoker n=114 (65%)	Former smoker n=32 (18%)	Current smoker n=29 (17%)	p-value[1]
Initial Pain Scale (out of 10)					0.3
Median (IQR)	5.5 (4.0, 8.0)	5.0 (3.8, 7.5)	5.0 (4.0, 8.0)	7.0 (4.0, 8.0)	
Range	0.0, 10.0	0.0, 10.0	0.0, 10.0	2.0, 10.0	
Unknown	22	15	3	4	

[1] Kruskal-Wallis rank sum test

Characteristic	Overall n=175	Smoking (No=non-smoker, Yes=former smoker/current smoker) No n=114 (65%)	Yes n=61 (35%)	p-value[1]
Initial Pain Scale (out of 10)				0.2
Median (IQR)	5.5 (4.0, 8.0)	5.0 (3.8, 7.5)	6.0 (4.0, 8.0)	
Range	0.0, 10.0	0.0, 10.0	0.0, 10.0	
Unknown	22	15	7	

[1] Wilcoxon rank sum test

Race/ethnicity	Overall (n = 175)	Non-Smoker (n = 114, 65%)	Former smoker (n = 32, 19%)	Current smoker (n = 29, 16%)
White	53 (30.3%)	28 (24.6%)	13 (40.6%)	12 (41.4%)
NHPI	25 (14.3%)	17 (14.9%)	3 (9.4%)	5 (17.2%)
Asian	28 (16.0%)	18 (15.8%)	6 (18.8%)	4 (13.8%)
Other	25 (14.3%)	21 (18.4%)	2 (6.3%)	2 (6.9%)
Unknown	44 (25.1%)	30 (26.3%)	8 (25.0%)	6 (20.7%)

Characteristic	Overall (n = 175)[1]	Non-Smoker (n = 114, 65%)[1]	Former smoker (n = 32, 19%)[1]	Current smoker (n = 29, 16%)[1]	p-value[2]
Depression	55 (30.9%)	36 (31.6%)	6 (18.8%)	12 (41.4%)	0.2
Anxiety	40 (22.9%)	27 (23.7%)	5 (15.6%)	8 (27.6%)	0.5
PTSD	11 (6.3%)	8 (7.0%)	1 (3.1%)	2 (6.9%)	0.8
ADHD/ADD	7 (4.0%)	7 (6.2%)	0 (0.0%)	0 (0.0%)	0.3
Bipolar disorder	4 (2.3%)	4 (3.5%)	0 (0.0%)	0 (0.0%)	0.6
Number of recorded psychiatric comorbidities					0.3
0	94 (54%)	58 (51%)	22 (69%)	14 (48%)	
1	41 (24%)	27 (24%)	7 (22%)	7 (24%)	
>1	39 (22%)	28 (25%)	3 (9.4%)	8 (28%)	

[1] n (%)
[2] Pearson's Chi-squared test; Fisher's exact test

Conclusions/Discussion

Our results found that perceived pain ratings were not different between non-smokers and former or current smokers. However, more former and current smokers had current opioid use documented in their charts. This finding is consistent with the current literature that smokers are more susceptible to opioid use disorders. Furthermore, opioid-dependent patients are less likely to adhere to smoking cessation techniques.[6] These findings elucidate the importance of discovering alternative medications and treatment options for chronic pain in former and current smokers.

Prevalence of insurance type also differed between groups, with more non-smokers utilizing public insurance and more former/current smokers utilizing private insurance. There is a lack of research on insurance types across chronic pain patients who smoke, but those with chronic diseases are more likely to use public insurance.[5]

Furthermore, spine pain was found to be a common comorbidity among chronic pain patients. This supports previous research that found a higher prevalence of back pain in former and current smokers.[7]

Number of documented medical comorbidities also varied across race and ethnicities. An interesting finding is that of the 25 NHPI patients, all of them had one or more additional comorbidities along with a chronic pain diagnosis. However, it is important to note that there are many patients listed as unknown in this category.

There are several limitations to this study. Due to the nature of a retrospective chart review, our data depends on patient reporting and accurate documentation in their charts. Patients may have quit smoking or stopped using opioids during their time at HPN, which may not have been reported. A social desirability bias exists as well among the variables, with fewer patients likely reporting an accurate smoking status.

Future Directions

Many other sociodemographic factors not found in a retrospective chart review, such as education, income and religion, may affect chronic pain development and prognosis. Collecting these additional variables, along with the data missing from the current study, may provide a better understanding of chronic pain. Significant findings on insurance type might be an additional area of further study. Additionally, investigating the effect of behavioral interventions on smokers who use opioids may help address the higher rates of use-dependence in this group of patients.

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Disclosure/Correspondence

All authors reported no conflicts of interest.

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Identifying Racial Differences in Clinical Presentation of Obstructive Sleep Apnea in NHPI Patients

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Background

Obstructive sleep apnea (OSA) is the most common sleep-related breathing disorder, affecting millions of adults with increasing prevalence in the United States. It is characterized by multiple episodes of interrupted breathing caused by the complete or partial collapse of the airway during sleep, leading to reduced quality of life due to excessive daytime sleepiness. Additionally, OSA has been associated with declining cardiovascular health and cognitive function, resulting in decreased life expectancy.[1-3] Significant disparities in the clinical presentation of OSA have been identified in racial minority groups.[4-7] However, there has been little research on OSA in the Native Hawaiian and Pacific Islander (NHPI) population.[8]

The apnea-hypopnea index (AHI), collected through polysomnography, and is used to diagnose and determine the severity of OSA. It represents the average number of apneas (complete pauses in breathing) and hypopneas (partial reductions in airflow) per hour during sleep.[2,3] Previous literature has found that excess body weight is an important risk factor for the development of OSA.[3,7-11] Furthermore, higher BMI has been associated with increased AHI, suggesting a more severe presentation of OSA with increasing BMI.[11]

The NHPI population has presented with alarming rates of obesity and related health conditions. In the United States, NHPIs are significantly more likely to be obese compared to Whites.[12] Therefore, it is reasonable to suspect that OSA would have a high prevalence in NHPIs, and would have a more severe clinical presentation compared to Whites. However, to our knowledge, no studies have compared the clinical presentation of OSA in NHPIs to other racial groups. This study seeks to evaluate the clinical characteristics of OSA in NHPIs relative to Caucasians in Hawaii to provide a more comprehensive understanding of the impact of OSA on this understudied population.

Objectives

- To compare the clinical presentation of OSA between the NHPI population and Caucasian population.

Methods

- Patients diagnosed with OSA (ICD-10: G47.33) between January 1, 2013 and June 1, 2023
  - Native Hawaiian and Pacific Islander (n=121), White (n=190)
  - Excluded patients without polysomnography data
    - NHPI (n=91), White (n=190)
- Collected the following data by retrospective chart review:
  - **Demographics:** sex, age, race, zip code, insurance
  - **Clinical presentation:** STOP-BANG score, AHI Score and severity, enlarged neck circumference, Mallampati score, retrognathia
  - **Comorbidities:** Blood Pressure, Congestive Heart Failure, Arrhythmias, Stroke, Myocardial Infarction, PHQ-9 score, Illicit Drug use)
  - **Social history:** prior or current alcohol, tobacco, or drug use

Inclusion Criteria

- Patient has OSA ICD-10 code G47.33 + polysomnography conducted at HPN
- Patient identifies as either Native Hawaiian/Pacific Islander or White

Exclusion Criteria

- Patient has no reported AHI score
- Patient's polysomnography data was not available

Statistical Analysis Methods:

- Pearson's Chi-squared tests and Fisher's exact tests used to determine if there were any associations between AHI severity categories and patient demographics and clinical characteristics.
- Wilcoxon rank sum test was used to assess for associations between continuous variables such as age, number of strokes, and number of MIs with AHI severity categories ("Normal/Mild, Moderate/Severe".
- Univariate and multivariable logistic regression models were used to estimate the association between AHI severity and race, BMI, STOP-BANG score groups, presence of enlarged neck circumference, and history of myocardial infarction.
- Odds ratios and their 95% confidence intervals (CI) were determined. P values <0.05 were considered statistically significant. Statistical analyses were performed using version 4.2.0 of R software (R Core Team, 2022).

Results

- The odds of Native Hawaiians being diagnosed with moderate or severe AHI severity scores were more than **two times greater** than Caucasians (adjusted odds ratio (AOR) = 2.84 [95% CI: 1.20, 7.03]).
- BMI, high STOP-BANG score, enlarged neck circumference, and history of MI were positively associated with moderate-severe OSA

Table 1. Comparison of Significant Clinical Characteristics with AHI Severity Categories

Characteristic	Overall, N = 220[1]	Normal/Mild, N = 93[1]	Moderate/Severe, N = 127[1]	p-value[2]
BMI				**0.017**
Healthy	26 (100.0%)	12 (46.2%)	14 (53.8%)	
Overweight	60 (100.0%)	34 (56.7%)	26 (43.3%)	
Obese	134 (100.0%)	47 (35.1%)	87 (64.9%)	
STOP-BANG score				**0.014**
Low Risk	30 (100.0%)	15 (50.0%)	15 (50.0%)	
Intermediate Risk	51 (100.0%)	25 (49.0%)	26 (51.0%)	
High Risk	69 (100.0%)	18 (26.1%)	51 (73.9%)	
(Data Not Available)	70	35	35	
Enlarged Neck Circumference	32 (100.0%)	7 (21.9%)	25 (78.1%)	**0.021**
(Data Not Available)	85	40	45	
Myocardial Infarction				**0.027**
Not Present	205 (100.0%)	91 (44.4%)	114 (55.6%)	
Present	14 (100.0%)	2 (14.3%)	12 (85.7%)	
(Data Not Available)	1	0	1	
Number of Myocardial Infarction	0 (0.3)	0 (0.1)	0 (0.4)	**0.028**

[1] n (%); Mean (SD)
[2] Pearson's Chi-squared test; Wilcoxon rank sum test; Fisher's exact test

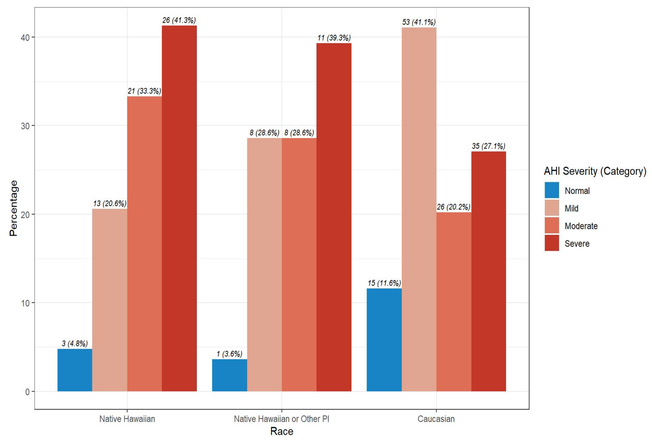
Table 2. Adjusted Logistic Regression of Significant Characteristics

Characteristic	OR[1]	95% CI[1]	p-value
Race			
Caucasian	—	—	
Native Hawaiian	2.84	1.20, 7.03	**0.020**
Native Hawaiian or Other PI	5.41	1.12, 41.1	0.056
BMI			
Healthy	—	—	
Overweight	0.42	0.12, 1.44	0.2
Obese	0.39	0.11, 1.30	0.13
STOP-BANG score			
Low Risk	—	—	
Intermediate Risk	0.68	0.24, 1.86	0.4
High Risk	2.09	0.71, 6.30	0.2
Enlarged neck circumference			
No	—	—	
Yes	2.40	0.79, 7.84	0.13
Myocardial Infarction			
Not Present	—	—	
Present	0.74	0.12, 5.96	0.8

[1] OR = Odds Ratio, CI = Confidence Interval

- 74.6% (n=47) of Native Hawaiian patients had moderate or severe OSA based on the AHI score while 52.7% (n=68) of Caucasian patients had normal or mild OSA **(p<0.001)**.

Figure 1. AHI Severity by Race



- There was a statistically significant difference between NHPI and Caucasian cohorts in BMI and history of MI

Figure 2. Race vs. BMI

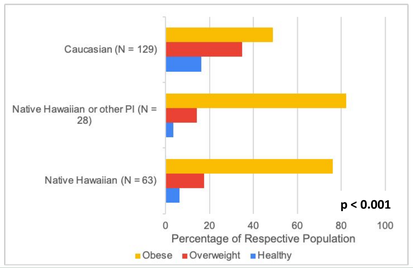
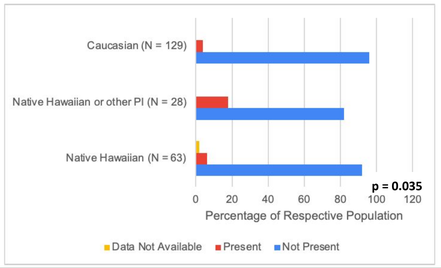


Figure 3. Race vs. History Of MI



Discussion/Conclusion

- Native Hawaiians are 2.84 times more likely to be diagnosed with moderate or severe OSA than Caucasians.
- The results of the study showed that NHPI faced a greater burden of comorbidities and symptoms, as indicated in their higher STOP–BANG scores, Epworth sleepiness scale stores, and other AHI categories, proving their clinical presentation of OSA is worse than that of their white counterparts.
- Our findings suggest that significant differences in obesity and myocardial infarction rates between NHPI and Caucasians could point to a correlation between those factors and a patient's OSA severity.
- Genetics may play a key role in the racial differences between NHPI and Caucasians. More information about differences in average Mallampati score would be needed to draw conclusions about the role of facial structure in the presentation of OSA.
- The late detection of OSA, as proven in previous literature, could contribute to the severity of OSA in the NHPI population. Minimal education of OSA symptoms may lead to barriers to early treatment in the NHPI patients.
- Some other potential barriers could include limited insurance access and less time to attend doctor appointments.
- Our findings suggest that future treatments of OSA should be adjusted to accommodate for the presence of comorbidities that disproportionately impact different racial groups, such as the NHPI population

Several limitations to the study need to be considered.

- Patient data was collected from a single clinic on O'ahu, so it was difficult to obtain a representative sample for all NHPI patients with OSA.
- Mixed race patients could not be accounted for, as there was no filter in the HPN database for those who identified as both Native Hawaiian and Caucasian.
- Not all conditions were evaluated at HPN, likely due to prior diagnosis at another clinic or with another primary care physician.
- Scoring systems to assess OSA diagnosis varied between clinicians, so data collection was incomplete.

Future Directions

- Future studies should determine factors that lead to late detection of OSA in the NHPI population.
- Expanding this study to include OSA patients from other sleep centers and clinics may more accurately reflect the population of Hawaii

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Disclosure/Correspondence

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Factors Associated with Depression Risk in Post-Concussive Syndrome Patients in Hawaii

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Background

Mild traumatic brain injury (mTBI) poses a significant public health issue, affecting nearly 1.5 million patients in the U.S. annually. Approximately 90% of concussion symptoms are transient and resolve within 10-14 days after the initial insult. However, some patients may experience symptoms that linger weeks to months after the injury. Post-concussion syndrome (PCS) refers to a collection of somatic, cognitive, behavioral, and emotional symptoms that continue beyond the typical recovery time frame observed in the natural progression of a concussion. These symptoms typically persist for more than three weeks after the initial concussion has occurred, but current literature describes no consensus timeframe for when persistent concussion symptoms become PCS. Depression is one of the most common sequelae of traumatic brain injury, carrying a 1.5x increased risk for adults who suffer one or two concussions and up to a 3x increased risk for adults who suffer three or more concussions. Due to the multifactorial pathophysiology of PCS, effective management remains challenging. Therefore, understanding the risk factors associated with depression in PCS may inform the development of a safe and efficacious treatment plan for PCS. This study aims to assess patient demographics, concussion etiologies, PCS symptoms, substance use, and medication use associated with risk of depression in patients with PCS.

Objectives

- Identify potential factors contributing to the increased depression risk in PCS patients.
- Evaluate the efficacy of antidepressant medications as a treatment option for patients at risk of PCS-related depression.
- Emphasize the significance of regular interval screening for depression in patients diagnosed with mTBI and/or PCS.

Methods

- A single-center retrospective chart review of 297 patients diagnosed with PCS from January 2020 to January 2023 was conducted.
- Variables collected included patient demographics, etiologies of concussion, PCS symptoms, PHQ-2/PHQ-9 surveys, substance use pre- and post-PCS diagnosis, and medications pre- and post-PCS diagnosis.

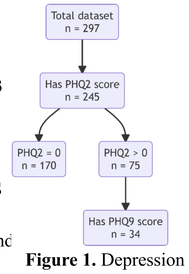

Figure 1. Depression Screening Among PCS Patients

- Patients were categorized as 'not at-risk of depression' or the 'at-risk of depression' depending on whether they scored zero or greater than zero on the initial PHQ-2 survey, respectively.
- Statistical analysis was performed using RStudio version 4.3.1.
- P-values were calculated using Fisher's exact tests and Wilcoxon rank sum tests.

Results

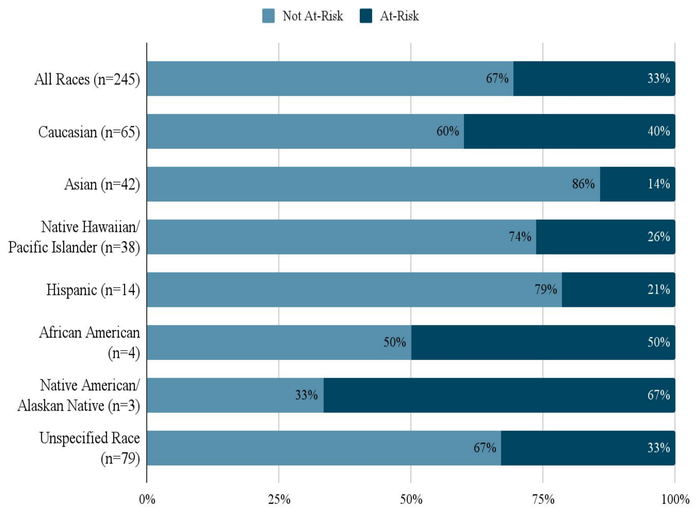

Figure 2. PCS-Related Depression Risk by Race

LOC	Overall (N = 245)	# Patients not at risk of depression (%) (N = 170)	# Patients at risk of depression (%) (N = 75)	p-value
No LOC	111 (100%)	79 (71%)	32 (29%)	0.675
LOC unspecified duration	62 (100%)	36 (58%)	26 (42%)	**0.037**
LOC not specified	39 (100%)	27 (69%)	12 (31%)	>0.999
LOC ≤ 30 min	32 (100%)	24 (75%)	8 (25%)	0.831
LOC 31-59 min	2 (100%)	2 (100%)	0 (0%)	>0.999
LOC 1-6 hr	1 (100%)	1 (100%)	0 (0%)	>0.999
LOC 6-24 hr	0 (NA%)	0 (NA%)	0 (NA%)	N/A
LOC ≥ 24 hr	3 (100%)	2 (67%)	1 (33%)	>0.999

Table 1. PCS-Related Depression Risk by LOC Status Following mTBI

Symptom	Overall (N = 245)	# Patients not at risk of depression (%) (N = 170)	# Patients at risk of depression (%) (N = 75)	p-value
Headache	214 (100%)	150 (70%)	64 (30%)	0.677
Fatigue	47 (100%)	28 (60%)	19 (40%)	0.112
Vision Changes	96 (100%)	61 (64%)	35 (36%)	0.117
Balance Disturbances	96 (100%)	62 (65%)	34 (35%)	0.199
Confusion	40 (100%)	21 (53%)	19 (48%)	**0.014**
Dizziness	153 (100%)	104 (68%)	49 (32%)	0.475
Insomnia	106 (100%)	66 (62%)	40 (38%)	**0.035**
Difficulty Concentrating	119 (100%)	78 (66%)	41 (34%)	0.210
Memory Loss	146 (100%)	91 (62%)	55 (38%)	**0.003**

Table 2. PCS-Related Depression Risk by Symptoms at PCS Diagnosis

- The greatest difference in PCS-related depression risk by race was between Asian (14%) and Caucasian (40%) patients (Figure 2). However, the difference was deemed insignificant after adjusting for a confounding effect (p=0.075).
- Patients who experienced loss of consciousness (LOC) of an unspecified duration were at a significantly higher risk of developing PCS-related depression (Table 1).
- Significantly increased risk of depression was seen in patients that:
  - Experienced confusion, insomnia, or memory loss at PCS diagnosis (Table 2).
  - Used tobacco pre-TBI, marijuana pre-TBI, or marijuana post-TBI (Table 3).
  - Used SSRIs, SNRIs, atypical antidepressants, or mood stabilizers pre-TBI or used atypical antidepressants post-TBI (Table 4).

Substance	Overall (N = 245)	# Patients not at risk of depression (%) (N = 170)	# Patients at risk of depression (%) (N = 75)	p-value
Alcohol (pre-TBI)	91 (100%)	56 (62%)	35 (38%)	0.063
Alcohol (post-TBI)	79 (100%)	49 (62%)	30 (38%)	0.132
Tobacco (pre-TBI)	50 (100%)	28 (56%)	22 (44%)	**0.039**
Tobacco (post-TBI)	36 (100%)	21 (58%)	15 (42%)	0.171
Marijuana (pre-TBI)	19 (100%)	7 (37%)	12 (63%)	**0.003**
Marijuana (post-TBI)	20 (100%)	8 (40%)	12 (60%)	**0.009**
Stimulants (pre-TBI)	3 (100%)	2 (67%)	1 (33%)	>0.999
Stimulants (post-TBI)	1 (100%)	0 (0%)	1 (100%)	0.313
Opioids (pre-TBI)	6 (100%)	4 (67%)	2 (33%)	>0.999
Opioids (post-TBI)	9 (100%)	6 (67%)	3 (33%)	>0.999
Other illicit drugs (pre-TBI)	2 (100%)	0 (0%)	2 (100%)	0.096
Other illicit drugs (post-TBI)	0 (0%)	0 (0%)	0 (0%)	N/A

Table 3. PCS-Related Depression Risk by Substance Use

Medication	Overall (N = 245)	# Patients not at risk of depression (%) (N = 170)	# Patients at risk of depression (%) (N = 75)	p-value
SSRI (pre-TBI)	34 (100%)	16 (47%)	18 (53%)	**0.005**
SSRI (post-TBI)	34 (100%)	19 (56%)	15 (44%)	0.107
SNRI (pre-TBI)	12 (100%)	4 (33%)	8 (67%)	**0.010**
SNRI (post-TBI)	25 (100%)	13 (52%)	12 (48%)	0.064
SARI (pre-TBI)	7 (100%)	3 (43%)	4 (57%)	0.207
SARI (post-TBI)	12 (100%)	8 (67%)	4 (33%)	>0.999
Atypical antidepressants (pre-TBI)	19 (100%)	9 (47%)	10 (53%)	**0.040**
Atypical antidepressants (post-TBI)	20 (100%)	8 (40%)	12 (60%)	**0.005**
Tricyclic antidepressants (pre-TBI)	12 (100%)	7 (58%)	5 (42%)	0.522
Tricyclic antidepressants (post-TBI)	40 (100%)	28 (70%)	12 (30%)	>0.999
Benzodiazepines (pre-TBI)	23 (100%)	18 (78%)	5 (22%)	0.477
Benzodiazepines (post-TBI)	25 (100%)	18 (72%)	7 (28%)	0.822
2nd-gen Antipsychotics (pre-TBI)	12 (100%)	5 (42%)	7 (58%)	0.051
2nd-gen Antipsychotics (post-TBI)	14 (100%)	8 (57%)	6 (43%)	0.372
Mood stabilizers (pre-TBI)	20 (100%)	9 (45%)	11 (55%)	**0.022**
Mood stabilizers (post-TBI)	41 (100%)	31 (76%)	10 (24%)	0.356

Table 4. PCS-Related Depression Risk by Medication Use

Conclusions/Discussion

Of the initial 297 patients, 52 were not screened for depression following TBI, emphasizing the need to standardize screening protocols for mTBI patients in the US.

Our findings match older literature suggesting that the prevalence of depression is higher in Caucasians than other races, but more recent literature shows non-Caucasians have similar or sometimes higher depression rates than Caucasians.

Research has shown that concussions with LOC often involve higher strain and deformation of brainstem regions. Additionally, depression has been correlated with brainstem abnormalities. Our data supports the hypothesis that mTBI-induced alterations to the brainstem may play a significant role in the pathophysiology of PCS-related depression.

Symptoms of confusion, insomnia, and memory loss at PCS diagnosis correlated with a significantly higher risk of depression. These findings may be explained by either an underlying pathophysiological mechanism or by the patient's experience with these symptoms.

Both concussions and consistent tobacco use separately result in decreased acetylcholine release in the brain. Therefore, the compounded effect of decreased acetylcholine release may be responsible for the increased depression risk observed in PCS patients who used tobacco pre-TBI.

Literature has shown that patients who use marijuana are more likely to be affected by mental illnesses such as depression, although there have been conflicting reports about the directionality of this relationship. This analysis shows the same positive correlation between marijuana use and depression risk exists in patients with PCS.

Increased risk of depression was found in patients who used SSRIs, SNRIs, atypical antidepressants, and mood stabilizers pre-TBI. This supports our hypothesis that patients with pre-existing psychiatric conditions are more likely to experience depression following mTBI.

This study was limited to retrospective chart review from a single neurology clinic. However, this study identified several risk factors associated with PCS-related depression that were not previously examined. Additionally, the diverse population of Hawaii included in this study offered unique demographic insights compared to previous studies. These findings emphasized the need for standardized depression screening protocols for mTBI patients and offered insights informing improved mTBI patient management.

Future Directions

- Development of standardized protocols for depression screening in mTBI patients.
- Prospective studies focusing on relationships between PCS-related depression and introduction and stoppage of substances and medications following mTBI.
- Studies examining aforementioned neural pathways specifically in PCS patients.

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Factors Associated with Risk for Depression in People with Epilepsy

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Background

- Depression is the most common psychiatric comorbidity in individuals with epilepsy, affecting 32% of patients.[1] This is significantly higher than the incidence of depression in the general population.
- The PHQ-2 and PHQ-9 surveys are two standardized self-report questionnaires used in sequence to screen for and monitor the severity of depression. Patients with a score of nine or greater are at risk for moderate depression.[2] The PHQ-9 has been validated for use in patients with epilepsy, demonstrating its utility in monitoring for depression in this at risk population.[3]
- While several studies have explored the association between depression and epilepsy,[4-6] limited research investigates the risk factors for a positive depression screening with the PHQ-2/PHQ-9 paradigm in an outpatient neurology clinic setting. No studies to date have explored depression risk within Native Hawaiian and Pacific Islander people with epilepsy.

Objectives

This study aims to investigate the demographic, therapeutic, and diagnostic factors associated with positive PHQ-9 screening scores in individuals with epilepsy in order to assist in early identification and create targeted interventions for depression in patients with epilepsy.

We will also explore the factors that predispose Native Hawaiian and Pacific Islander (NHPI) patients with epilepsy to depression.

Methods

- This study was a retrospective chart review of 126 patients at a private outpatient neurology clinic in Honolulu, Hawaii.
- Inclusion criteria: Patients 18 years or older who were diagnosed with epilepsy (identified through a database search for the G40 ICD-10 code) were included.
- Exclusion criteria: Patients who did not not have an existing diagnosis of epilepsy prior to administration of PHQ-2/PHQ-9, or who underwent the PQH2/PHQ-9 before 2015 were excluded after chart review.
- Participants were selected for the PHQ-9 positive group if they had a score of nine or greater, meeting the DSM-5 criteria for moderate depression. Participants with a score of one or zero on the PHQ-2 were included in the control group, as according to the PHQ-2/PHQ-9 paradigm, these patients are not at risk for depression.
- Chart review was performed by KY, JM, KK. Charts were reviewed for demographic variables (date of birth, sex, race, zip code), insurance coverage, working status, and clinical variables such as seizure etiology, comorbidities (physical disease and psychiatric health), and medications (anti-epileptic and antidepressants).
- Statistical analysis was conducted by KI. Control and test groups were compared using Wilcoxon rank sum test for continuous data and Fisher's exact test for categorical data.
- Within group analyses of positive PHQ-9 patients and NHPI patients were also conducted.
- All statistical analyses will be performed using R (version 2023.06.1, Posit Software, PBC) with statistical significance set at $p < 0.05$.

Results

- 64 patients with a score of 9 or greater on the PHQ-9 were included in the test group. 62 patients with a score of 0 or 1 on the PHQ-2 were included in the control group.
- Patients with positive PHQ-9 scores were significantly more likely to use nicotine, alcohol, marijuana or controlled substances ($p < 0.002$). Nicotine alone predicted higher PHQ-9 scores than patients with negative PHQ-2 scores ($p < 0.018$).
- There was a marginally significant difference in average age between PHQ-2 negative and PHQ-9 positive patients (Table 1).

Characteristic	Negative PHQ2 N = 62[1]	Positive PHQ9 N = 64[1]	p-value[2]
Age	41 (29, 57)	48 (37, 62)	**0.069**
BMI			0.628
Underweight	4 (7.0%)	4 (6.3%)	
Healthy weight	15 (26%)	21 (33%)	
Overweight	22 (39%)	19 (30%)	
Obese	16 (28%)	19 (30%)	
Unkown	5	1	
Sex			> 0.999
Female	32 (52%)	32 (51%)	
Male	30 (48%)	31 (49%)	
Race /Ethnicity			
White	22 (56%)	22 (47%)	0.835
Asian	7 (17%)	6 (16%)	0.768
Native Hawaiian	10 (24%)	10 (27%)	> 0.999
Pacific Islander	4 (9.8%)	3 (8.1%)	0.708
American Indian	1 (2.6%)	1 (2.7%)	> 0.999
Black/African American	1 (2.4%)	0 (0.0%)	> 0.999
Hispanic	1 (2.4%)	1 (2.7%)	> 0.999
Unknown	21	27	
Working Status			0.46
Employed	14 (44%)	10 (50%)	
Unemployed	11 (34%)	7 (35%)	
Retired	3 (9.4%)	3 (15%)	
Student	4 (13%)	0 (0%)	
Unknown	30	44	
Insurance Coverage			0.81
Medicaid/Medicare	39 (64%)	43 (69%)	
Military	6 (9.8%)	5 (8.1%)	
Private	16 (26%)	14 (23%)	
Drug Use			
Use of any drug	**9 (16%)**	**20 (44%)**	**0.002**
Nicotine	**8 (13%)**	**16 (25%)**	**0.018**
Marijuana	2 (3.2%)	2 (3.1%)	>0.999
Excessive Alcohol	2 (3.2%)	3 (4.7%)	>0.999
Controlled Subtances	1 (1.6%)	1 (1.6%)	>0.999
None	**48 (77%)**	**25 (39%)**	**<0.001**
Unknown	**6 (9.7%)**	**19 (30%)**	**0.007**

Table 1. Demographic variables associated with depression risk

- Patients with positive PHQ-9 scores were significantly more likely to have one or more health comorbidities than patients negative PHQ-2 scores ($p < 0.012$).
- There was a significantly higher frequency of positive PHQ-9 patients diagnosed with anxiety ($p < 0.029$) and bipolar disorder ($p < 0.017$) than negative PHQ-2 patients (Table 2).

Characteristic	Negative PHQ2 N = 62[1]	Positive PHQ9 N = 64[1]	p-value[2]
Health Comorbidities			
None	**38 (61%)**	**24 (38%)**	**0.012**
Any	**24 (39%)**	**40 (63%)**	**0.012**
Diabetes	4 (6.5%)	4 (6.3%)	>0.999
Hypertension	12 (19%)	22 (34%)	0.072
Cardiovascular disease	4 (6.5%)	9 (14%)	0.242
Dyslipidemia	8 (13%)	8 (13%)	>0.999
Cancer	2 (3.2%)	3 (4.7%)	>0.999
Asthma	4 (6.5%)	8 (13%)	0.364
Dysthyroid	0 (0%)	5 (7.8%)	0.058
Other	13 (21%)	18 (28%)	0.411
Psychiatric Comorbidities			
Depression	9 (15%)	21 (33%)	**0.021**
Anxiety	8 (13%)	19 (30%)	**0.029**
Unstated Psychosis	0 (0%)	1 (1.6%)	>0.999
Bipolar Disorder	1 (1.6%)	9 (14%)	**0.017**
Schizophrenia	2 (3.2%)	3 (4.7%)	>0.999
Obsessive Compulsive Disorder	2 (3.2%)	0 (0%)	0.24
Attention deficit disorder	1 (1.6%)	1 (1.6%)	>0.999
ADHD	3 (4.8%)	1 (1.6%)	0.361
Post traumatic stress disorder	4 (6.5%)	2 (3.1%)	0.436
Somatoform disorder	1 (1.6%)	0 (0%)	0.492
Dysthymic disorder	2 (3.2%)	2 (3.1%)	>0.999
None	35 (56%)	29 (45%)	0.219

Table 2. Health and psychiatric comorbidities by depression risk

- Native Hawaiian and Pacific Islander patients with positive PHQ-9 scores were significantly more likely than other races to have asthma ($p<0.042$), have hypertension ($p<0.045$), and to be either overweight or obese ($p<0.006$) than patients with negative PHQ-2 scores (Table 3).

Characteristic	Not NHPI N=34[1]	NHPI N = 13[1]	p-value[2]
BMI			**0.006**
Underweight	4 (12%)	0 (0%)	
Healthy weight	13 (38%)	2 (15%)	
Overweight	12 (35%)	2 (15%)	
Obese	3 (13%)	9 (69%)	
Comorbidities			
Hypertension	11 (32%)	9 (69%)	**0.045**
Asthma	2 (5.9%)	4 (31%)	**0.042**

Table 3. Comparing NHPI and other races in patients at risk for depression

- Among NHPI patients, those with a positive PHQ-9 score are more likely to have cardiovascular disease ($p<0.041$), and be diagnosed with anxiety ($p<0.016$).
- Of note, this sub analysis showed only a marginally significant difference in frequency of depression diagnosis (Table 4).

Characteristic	Negative PHQ2 N = 14[1]	Positive PHQ9 N = 13[1]	p-value[2]
Cardiovascular disease	0 (0%)	4 (31%)	**0.041**
Depression	2 (14%)	6 (46%)	0.103
Anxiety	0 (0%)	5 (38%)	**0.016**
Use of Any Drug	1 (7.7%)	5 (50%)	0.052
Use of Nicotine	1 (7.7%)	5 (50%)	0.052

Table 4. Risk factors for depression in NHPI patients

- There was no statistically significant difference between negative PHQ-2 patients and positive PHQ-9 patients in epilepsy diagnosis or the number of AEDs used in treatment (Table 5).

Characteristic	Negative PHQ2 N = 62[1]	Positive PHQ9 N = 64[1]	p-value[2]
Seizure Type			>0.999
Focal Onset	51 (82%)	52 (81%)	
Generalized Onset	5 (8.1%)	5 (7.8%)	
Indeterminate Seizure Type	6 (9.7%)	6 (9.4%)	
Non-Diagnostic	0 (0%)	1 (1.6%)	
Number of AEDs used			0.727
Zero	7 (11%)	5 (7.8%)	
One	33 (53%)	36 (56%)	
Two	15 (24%)	13 (22%)	
Three	4 (6.5%)	8 (13%)	
Four	2 (3.2%)	1 (1.6%)	
Five	1 (0.8%)	0 (0.0%)	
Family history of epielpsy	3 (5.7%)	2 (3.8%)	>0.999

Table 2. Epilepsy diagnosis and treatment approach by depression risk

Discussion

The present study examined the relationship between PHQ-9 depression scores and various factors within a cohort of 126 epilepsy patients. There was a significant link between elevated depression scores and drug use of one or more substances, as well as nicotine alone.. Consistent with existing literature, there was a marginally significant relationship between older age and high screening scores.[6]

Patients with positive PHQ-9 scores were more likely to have an additional health problem compared to patients with negative PHQ-2 scores. Moreover, there were significantly more patients with a diagnosis of depression with positive PHQ-9 scores than positive PHQ-2 scores, indicating the internal validity of this study. Remarkably, 15% of patients with negative PHQ-2 scores had an existing depression diagnosis, potentially reflecting adequate management of depression symptoms.

There was also a significant correlation between positive PHQ-9 scores and the presence of anxiety and bipolar disorder diagnoses. This is in line with previous studies that demonstrate the relationship between epilepsy, depression, and anxiety.[6]

Our study also explored depression risk within the NHPI population. There is a relatively high proportion of NHPI patients within our cohort, potentially due to a preference to report one racial makeup over another. Despite the small sample size, there were significant associations between positive PHQ-9 scores and the diagnosis of asthma, hypertension, and obesity. It is important to note that the difference in frequency of depression between PHQ-2 negative and PQH9 positive patients did not differ significantly. In order to reach significance, a larger sample of NHPI patients should undergo similar analysis.

Our results do not show an association between seizure etiology and depression risk, consistent with the findings of previous studies. However, our results also did not show a relationship between depression risk and female gender, unemployment, and polytherapy that has been demonstrated in previous literature.6

In conclusion, our study offers further insight into the screening of depression in epilepsy and the first data characterizing the relationship between epilepsy and depression in an NHPI population. These factors may serve as red flags in the screening process, prompting clinicians to consider administering the PHQ-9 assessment to patients, even in cases where the PHQ-2 screen yields negative results.

Limitations: It is crucial to note that our analysis focuses on the relationship between depression screening and epilepsy, as opposed to clinical diagnosis. As a result, our study still highlights the specific characteristics and behaviors that should alert healthcare providers to the potential risk of depression, warranting further screening.

Additionally, a retrospective, cross sectional design invites temporal ambiguity and the potential for selection bias. Future investigation of depression in NHPI patients with epilepsy should be conducted via a prospective cohort study of a larger sample size.

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Disclosure/Correspondence

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Prevalent Onset Symptoms of Multiple Sclerosis in Native Hawaiian/Pacific Islander, Asian American and Caucasian Patients in Hawaii

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Background

Multiple sclerosis (MS) is a chronic degenerative disease of the central nervous system (CNS) characterized by demyelination and axonal degeneration in the brain and spinal cord, which are caused by an immune-mediated inflammatory process[1]. Exact etiology and pathogenesis of MS is not known, however, it is currently thought to be a result of viral, genetic, environmental, immunological, and psychosocial factors[2]. Additionally, MS is associated with various medical comorbidities, including that about 80% of MS patients experience psychiatric comorbidities and show symptoms such as depression, sleep disorders, irritability/emotional instability and indifference[2]. Onset symptoms of MS differ from one patient to another, making MS a challenging condition to diagnose[3].

Hawaii is unique due to its diverse patient population, which may yield different scientific outcomes and findings. This research will improve overall understanding of how MS presents in our local population.

Objectives

The goal of this study is to examine the baseline characteristics and onset symptoms of Asian American, Native Hawaiian/Pacific Islander, and Caucasian patients with multiple sclerosis in Hawaii.

Methods

We conducted a retrospective chart review of patient records using hospital data through eClinicalWorks software from Hawaii Pacific Neuroscience (HPN) with a diagnosis of MS from June 1st 2018 to June 26th 2023. The complete electronic health records with individuals with the ICD-10 code indicative of MS (G35) was used to identify patients with MS. Recorded data included: sex, age and age at onset of MS, race/ethnicity, type of MS (Relapsing-Remitting, 2° Progressive, 1° Progressive, Clinically Isolated Syndrome), onset symptoms, psychiatric comorbidities (depression, anxiety, bipolar disorder), medical comorbidities (asthma, DM, heart problems, HTN, HLD, hypercholesterolemia, incontinence, seizures, headache/migraine, stroke), and smoking history. Patients' race was self-identified according to the categories defined by the Office of Management and Budget. Socioeconomic variables were also recorded including insurance type and Zone Improvement Plan (zip) code of the patient's residence, with zip code serving as a proxy for other variables.

Patients were categorized into five race/ethnic groups. First, those who reported NHPI, or Asian were categorized as such. Those who reported to be only Caucasian were categorized as White. Those who reported Black, Alaska Native, American Indian, Hispanic, and any races other than White were categorized as Other. Those who did not specify their race/ethnicity were categorized as Unknown.
Patient characteristics were described in mean and standard deviations or median and interquartile range for continuous variables and frequency and percentage for categorical variables. Patient characteristics by race/ethnicity were examined by bivariate analysis. Differences across the race/ethnicity groups were examined by analysis of variance or Kruskal-Wallis rank sum test for continuous variables and Chi-square test or Fisher's exact test for categorical variables. Those with missing data were excluded from analysis. A p-value less than 0.05 was considered statistical significance.

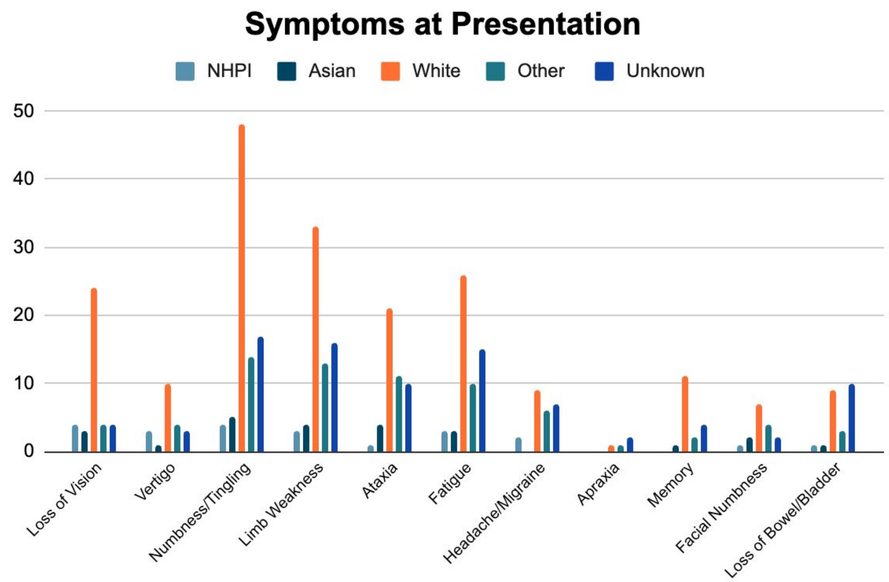
Results

Characteristic	Overall n=154[1]	Race/Ethnicity: White n=77 (50%)[1]	NHPI n=7 (4.5%)[1]	Asian n=8 (5.2%)[1]	Other n=23 (15%)[1]	Unknown n=39 (25%)[1]	p-value[2]
Age at Diagnosis of MS	36 (28, 46)	35 (28, 48)	29 (28, 39)	37 (29, 48)	34 (28, 40)	39 (30, 49)	0.5
Unknown	3	2	0	0	0	1	
MS Type							0.8
Relapsing Remitting	65 (48.5%)	35 (50.0%)	2 (66.7%)	3 (42.9%)	6 (30.0%)	19 (55.9%)	
Primary Progessive	49 (36.6%)	22 (31.4%)	1 (33.3%)	3 (42.9%)	11 (55.0%)	12 (35.3%)	
Secondary Progressive	14 (10.4%)	9 (12.9%)	0 (0.0%)	1 (14.3%)	2 (10.0%)	2 (5.9%)	
Clinicall Isolated Syndrome	6 (4.5%)	4 (5.7%)	0 (0.0%)	0 (0.0%)	1 (5.0%)	1 (2.9%)	
Unknown	20	7	4	1	3	5	

[1] Median (IQR); n (%)

[2] Kruskal-Wallis rank sum test; Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

- **Our sample (N=154) consisted of White (N= 77), NHPI (N= 7), Asian (N= 8), Other (N= 23), and Unknown (N= 39) racial groups.**
- **The average age of MS diagnosis was 36 years old overall, Unknown (39 years old), Asian (37 years old), White (35 years old), Other (34 years old), and NHPI (29 years old).**
- **Relapsing Remitting (N=65; 48.5%) was most prevalent MS type overall. NHPI MS patients were diagnosed with Relapsing Remitting (N= 2; 50%), Primary Progressive (N= 1; 33.3%). There were four unknown NHPI.**
- **Significant findings: NHPI significant for Loss of Vision as a presenting symptom (N= 4; p=0.025). NHPI significant for comorbid seizure (N= 4; p= 0.014) and headaches/migraines (N=4; p= 0.021).**



Conclusions/Discussion

Results are to build on current research of NHPI patients with MS.

- **NHPI are more likely to experience vision loss (p=0.025), comorbid seizures (p=0.014) and headaches/migraines (p=0.021) compared to White and Asian groups.**
- **NHPI represented the youngest group diagnosed with MS (43 years old; p=0.038); no significant findings for NHPI at age of diagnosis (p=0.5).**
- **NHPI are likely to have public health insurance (N=7; p=0.020).**

Limitations are similar to previous research done in the pacific.

- **Very little representation of NHPI and Asian American patients to effectively compare with Caucasian patients.**
- **Combining Native Hawaiians with Pacific Islanders is a potential barrier.**
- **Hawaii has a relatively high immigrant population. Previous studies have shown that MS risk is significantly associated with one's place of residence during early childhood[4]. Because place of birth and moving history is not obtained during patient screenings, a relationship between MS risk and place of residence during early childhood could not be drawn.**
- **Hawaii has an ethnically mixed population with many consequently identifying as Unknown (n=39); these data points were to omitted due to lack of information on race/ethnicity.**
- **Generally small sample size (n=154). A larger sample size would potentially reduce the margins of error and lessen the effects of outliers in the dataset.**

Future Directions

- **Examine baseline characteristics of MS between those born in Hawaii and those living in Hawaii but were born elsewhere in the northern hemisphere.**
- **Investigate treatment and treatment types prescribed to NHPI patients.**
- **Potentially explore Hawaii's military MS population as compared to the civilian or NHPI population.**

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Native Hawaiian and Pacific Islanders (NHPI) Risk Factors for Peripheral Neuropathy: An Ethnographic Study

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Background

Peripheral neuropathy, often interchangeably termed as polyneuropathy, encompasses a range of disorders characterized by deficits in sensory, motor, and autonomic functions. Its prevalence ranges between 2% to 8%, with the elderly population aged 50 and above being particularly susceptible. The leading cause of this condition is complications arising from diabetes, which typically manifests as an initial sensory dysfunction and gradually encompasses motor and autonomic systems.

Despite extensive research on peripheral neuropathy across various populations, there remains a significant gap concerning Native Hawaiian and Pacific Islanders (NHPI). Notably, NHPI adults exhibit a higher incidence of diabetes compared to other ethnic groups, suggesting a potential elevated risk of neuropathy. Furthermore, certain lifestyle factors, such as dietary habits and physical activity levels common in NHPI communities, might also play a pivotal role in neuropathy development. This study endeavors to delve deeper into these unique risk factors among the NHPI population, offering a comprehensive perspective by intertwining genetic, medical, and lifestyle considerations.

Objectives

1) Elucidate the risk factors for peripheral neuropathy in NHPI population
2) Compare the risk factors of peripheral neuropathy between NHPI and other ethnic groups
3) Compare the severity of neuropathy between NHPI and other ethnic groups

Methods

A retrospective review was conducted at a neurology clinic from 2003 to 2023, focusing on patients with nerve conduction studies. Selection was based on CPT codes (95861 to 95869) and ICD-10 codes for polyneuropathy (G60-G63). Those with incomplete records or lacking a documented study were excluded. The primary outcome was the presence and severity of neuropathy. Independent variables encompassed demographics, medical history, and neuropathy risk factors. For this study, risk factors were manually extracted from individual records, and demographic information was sourced from self-identification documentation during clinical visits..

Pearson's Chi-squared tests and Fisher's exact tests were used to determine if there were any associations between patient race groups and clinical characteristics of peripheral neuropathy. Kruskal-Wallis rank sum test was used to assess for associations between continuous variables such as number of abnormal nerves with race categories. Race was initially categorized into 8 groups according to Hawaii DOH guidelines (Sorensen CA, Wood B, Prince EW. Race & Ethnicity Data: Californian Journal of Health Promotion 2003;1:91–104. https://doi.org/10.32398/cjhp.v1iSI.561.). Smaller race group categories were then grouped together into 4 broad categories: Asian, Native Hawaiian and Pacific Islander (NHPI), Other Races, and White. P values <0.05 were considered statistically significant. Statistical analyses were performed using version 4.2.0 of R software (R Core Team, 2022).

Limitations of the study include potential selection bias due to the single-center design and the retrospective nature of the data collection, which may limit the generalizability of the findings.

Results

This study collected data from a sample of 298 patients from the HPN database who had a neuropathy test. About 58.2% (n=171) of patients were males and 41.8% (n=123) were females. Majority of patients were White (55.9%, n=136) while 21.8% (n=53) were Native Hawaiian and Pacific Islander (NHPI), 16.0% (n=39) were Asian, and 6.2% (n=15) were Other Races which included Black or African Americans, American Indians/Alaskan Natives, and Hispanics. About 4.4% (n=13) patients had a history of neuropathy among their immediate family.

Age group was found to be significantly associated with neuropathy as 37.5% (n=6) patients below the age of 35 were NHPI patients who received a neuropathy test while older patients aged 65 and above were of White or Asian race (p=0.005). Pre-existing conditions such as Type 2 Diabetes, obesity indicated by a BMI>30, and hypertension were significantly different among race groups as well (p=0.001).

Sensory symptoms were significantly different between NHPI and White race groups (p=0.018) while motor symptoms and autonomic symptoms were not found to be significant.

Table 1: Summary of Patient Demographics

Characteristic	Category	Count	Percentage
Age Group	Below 35	17	5.8%
	35-45	26	8.8%
	45-55	40	13.6%
	55-65	71	24.1%
	65-75	71	24.1%
	75-85	42	14.2%
	85 and above	28	9.5%
	(Data Not Available)	3	
Gender	Male	171	58.2%
	Female	123	41.8%
	(Data Not Available)	4	
Ethnicity	American Indian/Alaska Native	3	1.2%
	Asian	39	16.0%
	Black or African American	2	0.8%
	Hispanic	6	2.5%
	Native Hawaiian	41	16.9%
	Other Race	4	1.6%
	Pacific Islander	12	4.9%
	White	136	56.0%
	(Data Not Available)	55	
Insurance Type	Commercial	149	50.7%
	Government	128	43.5%
	Military	9	3.1%
	Other	8	2.7%
	Self-pay	0	0.0%
	(Data Not Available)	4	

Table 2: Summary of Patient Social History

	Yes, currently	No, formerly used	No, not at all	Unknown	Data Not Available
Alcohol Use	84 (28.8%)	5 (1.7%)	186 (63.7%)	17 (5.8%)	6
Tobacco Use	26 (8.9%)	59 (20.2%)	192 (65.8%)	15 (5.1%)	6
Illicit Drug Use	14 (4.8%)	0 (0.0%)	242 (82.9%)	36 (12.3%)	6

Table 3: Summary of Patient Medical History

Condition/History	Count & Percentage	Condition/History	Count & Percentage
History of Surgery Procedures	232 (78.1%)	History of Neuropathy Among Immediate Family	13 (4.4%)
History of Cancer	48 (16.1%)	Polypharmacy	173 (58.4%)
BMI	29 (10.9)	Diabetes Type 1	8 (2.7%)
Diabetes Type 2	57 (19.2%)	Obesity (BMI>30)	188 (63.1%)
Hypertension/Hypertriglyceridemia	158 (53.2%)	Hypothyroidism	22 (7.4%)
Kidney Problems	16 (5.4%)	Liver Failure	2 (0.7%)
Headache	18 (6.0%)	Chronic Fatigue Syndrome	3 (1.0%)
Chronic Pain Syndrome	12 (4.0%)	Hepatitis C	4 (1.3%)
Varicella Zoster (Chickenpox, Shingles)	2 (0.7%)	HIV	3 (1.0%)
Cytomegalovirus (CMV)	1 (0.3%)	Tuberculosis	1 (0.4%)
Cardiovascular Conditions	75 (25.3%)	Pulmonary Conditions	43 (14.5%)
Hematological Conditions	12 (4.0%)	GI or Nutritional-related Deficiency	43 (14.6%)
Musculoskeletal conditions	55 (18.6%)	Autoimmune Diseases	27 (9.1%)
Rosacea	15 (5.1%)	Otological Conditions	16 (5.4%)
Ophthalmologic Conditions	18 (6.0%)	Reproductive Conditions	17 (5.7%)

Table 4: Summary of Patient Demographics by Race Group

Characteristic	Overall, N = 2431	Asian, N = 391	NHPI, N = 531	Other Races, N = 151	White, N = 1361	p-value
Age Group						0.003
Below 35	16 (100.0%)	4 (25.0%)	6 (37.5%)	2 (12.5%)	4 (25.0%)	
35-45	17 (100.0%)	2 (11.8%)	5 (29.4%)	0 (0.0%)	10 (58.8%)	
45-55	31 (100.0%)	1 (3.2%)	7 (22.6%)	3 (9.7%)	20 (64.5%)	
55-65	58 (100.0%)	7 (12.1%)	17 (29.3%)	2 (3.4%)	32 (55.2%)	
65-75	61 (100.0%)	6 (9.8%)	12 (19.7%)	3 (4.9%)	40 (65.6%)	
75-85	36 (100.0%)	9 (25.0%)	5 (13.9%)	5 (13.9%)	17 (47.2%)	
85 and above	22 (100.0%)	9 (40.9%)	1 (4.5%)	0 (0.0%)	12 (54.5%)	
Gender						0.88
Male	139 (100.0%)	22 (15.8%)	29 (20.9%)	10 (7.2%)	78 (56.1%)	
Female	102 (100.0%)	16 (15.7%)	24 (23.5%)	5 (4.9%)	57 (55.9%)	

Table 5: Summary of Sensory Symptoms by Race Group

Characteristic	Overall, N = 2431	Asian, N = 391	NHPI, N = 531	Other Races, N = 151	White, N = 1361	p-value
Pain (generalized), hyperalgesia, allodynia	76 (100.0%)	7 (9.2%)	19 (25.0%)	5 (6.6%)	45 (59.2%)	0.24
Burning or stabbing pain	31 (100.0%)	2 (6.5%)	9 (29.0%)	1 (3.2%)	19 (61.3%)	0.34
Tingling, pins and needles, parathesias	76 (100.0%)	11 (14.5%)	16 (21.1%)	5 (6.6%)	44 (57.9%)	0.96
Numbness	144 (100.0%)	18 (12.5%)	37 (25.7%)	8 (5.6%)	81 (56.3%)	0.14
Temperature loss	87 (100.0%)	12 (13.8%)	24 (27.6%)	5 (5.7%)	46 (52.9%)	0.43
Vibratory loss	108 (100.0%)	16 (14.8%)	24 (22.2%)	6 (5.6%)	62 (57.4%)	0.94
Gait abnormalities	50 (100.0%)	7 (14.0%)	16 (32.0%)	5 (10.0%)	22 (44.0%)	0.091
Proprioceptive loss, loss of balance	243 (100.0%)	39 (16.0%)	53 (21.8%)	15 (6.2%)	136 (56.0%)	0.32

Table 6: Summary of Motor Symptoms by Race Group

Characteristic	Overall, N = 2431	Asian, N = 391	NHPI, N = 531	Other Races, N = 151	White, N = 1361	p-value2
Muscle twitching and fasciculations	13 (100.0%)	2 (15.4%)	0 (0.0%)	1 (7.7%)	10 (76.9%)	0.16
Muscle cramps	11 (100.0%)	4 (36.4%)	0 (0.0%)	0 (0.0%)	7 (63.6%)	0.10
Muscle weakness, loss of strength	64 (100.0%)	12 (18.8%)	16 (25.0%)	6 (9.4%)	30 (46.9%)	0.28
Muscle atrophy/thinning/wasting	19 (100.0%)	2 (10.5%)	7 (36.8%)	1 (5.3%)	9 (47.4%)	0.42

Table 7: Summary of Autonomic Symptoms by Race Group

Characteristic	Overall, N = 2431	Asian, N = 391	NHPI, N = 531	Other Races, N = 151	White, N = 1361	p-value
Dizziness/Fainting/Imbalance	47 (100.0%)	5 (10.6%)	16 (34.0%)	3 (6.4%)	23 (48.9%)	0.14
Urinary Problems	2 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (100.0%)	>0.99
Sexual difficulties	3 (100.0%)	0 (0.0%)	1 (33.3%)	0 (0.0%)	2 (66.7%)	>0.99
GI Problems	4 (100.0%)	1 (25.0%)	1 (25.0%)	0 (0.0%)	2 (50.0%)	0.85

Conclusions/Discussion

This study provides valuable insights into the prevalence and characteristics of peripheral neuropathy among different racial groups, with a particular focus on Native Hawaiian and Pacific Islander (NHPI) patients. The findings reveal significant associations between race, age, pre-existing conditions, and sensory symptoms of neuropathy.

The higher prevalence of neuropathy testing among NHPI patients below the age of 35 is a noteworthy observation. This may reflect specific genetic or lifestyle factors within this community that warrant further investigation. The lack of significant differences in motor and autonomic symptoms between NHPI and White race groups suggests that the underlying pathophysiology may be similar across these populations, despite differences in sensory symptoms.

The significant association between neuropathy and pre-existing conditions such as Type 2 Diabetes, obesity, and hypertension aligns with existing literature, emphasizing the importance of early detection and management of these conditions to prevent or mitigate neuropathy.

A limitation of this study is the single-center design, which may restrict the generalizability of the findings. Additionally, the categorization of race into broad groups may overlook nuanced differences within these categories. Future research could benefit from a multi-center approach and more detailed racial categorization to capture the complexity of these relationships.

The clinical implications of this study include the potential need for targeted screening and intervention strategies, particularly for younger NHPI patients. Healthcare providers should be aware of the specific risk factors and symptomatology within different racial groups to tailor care appropriately.

In conclusion, this study contributes to the understanding of racial disparities in peripheral neuropathy, highlighting the importance of age, race, and pre-existing conditions in the presentation and risk of this condition. The findings call for further research to explore the underlying mechanisms and develop targeted interventions for at-risk populations, particularly among NHPI communities

Future Directions

The findings of this study highlight the need for more nuanced and comprehensive research into peripheral neuropathy across diverse racial groups. Future studies should consider a multi-center approach and more detailed racial categorization, including specific subgroups within populations like the NHPI community, to capture the complexity of racial disparities. Investigating different scales for assessing neuropathy severity, exploring potential genetic or lifestyle factors, and developing targeted screening and intervention strategies are essential areas for further exploration.

The higher prevalence of neuropathy testing among younger NHPI patients and the significant association with pre-existing conditions such as diabetes and obesity emphasize the importance of personalized and culturally sensitive approaches to diagnosis and treatment. Longitudinal studies and inclusive research that encompasses underrepresented populations could provide deeper insights into the progression and long-term management of neuropathy.

By pursuing these directions, future research can contribute to a more complete understanding of peripheral neuropathy and its racial disparities. The integration of these insights into clinical practice and public health policies may lead to more equitable and effective care, particularly for at-risk populations like NHPI communities.

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The Safety and Efficacy of Dual and Sequential Calcitonin Gene-Related Peptide Therapies for Migraine Treatment

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Background

- Migraine is one of the most common neurological disorders affecting approximately 12% of the population >12 years of age in the United States[3].
- A recent FDA approval of four CGRP ligand monoclonal antibodies and three receptor antagonists have been proven to be effective and safe for preventative or acute treatment of migraines.
- Given that CGRP monoclonal antibodies and receptor antagonists have different mechanisms of action, dual CGRP blockade has the potential to provide increased relief, leading to improved patient outcomes[7].
- Specific combinations of different CGRPs have been shown to improve migraine management (rimegepant with erenumab and ubrogepant with anti-CGRP mAb), however no evidence suggests a more effective combination[5,6].
- While CGRP monoclonal antibodies and receptor antagonists have been proven safe when used together, little research suggests the efficacy of this practice[4,7].

Objectives

- To assess the safety and efficacy of dual CGRP therapies to inform clinicians about possible different treatment options.
- To assess the safety and efficacy of sequential CGRP therapies (taking a second CGRP after discontinuing a first CGRP).
- To assess the effect of CGRP combination type on treatment outcomes.

Methods

<u>Retrospective Chart Review</u> (May 2018 ~ July 2023)

Patient Screening
Dual-CGRP (N = 67)
or
Sequential CGRP (N = 21)

CGRP used:
Erenumab, fremanezumab, galcanezumab, eptinezumab, ubrogepant, rimegepant, atogepant

⬇

Record Variables
Age of onset
Current age (avg. 46 yrs old)
Sex (28% M, 72% F)
Race
Ethnicity

⬇

Collect Pre- and Post-Treatment Data
Monthly headache frequency
Headache severity (0-10)
Baseline presenting symptom
Medications (44% onabotulinumtoxinA use)
Adverse events (11%)

Duration: evaluated over 1-8 months post-treatment

Results

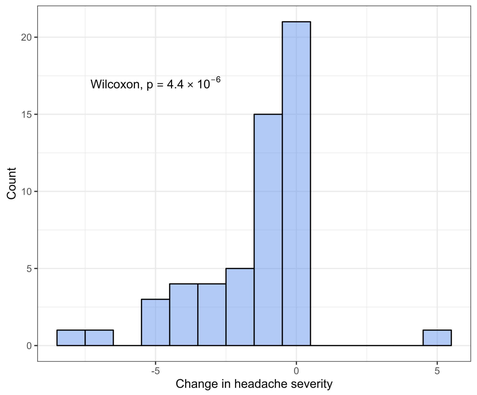

Figure 1. Distribution of change in headache severity for patients on dual-CGRP regimen.

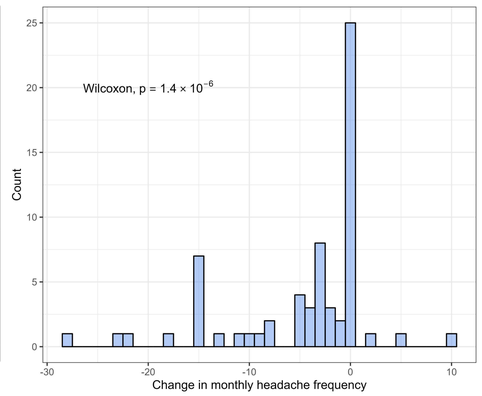

Figure 2. Distribution of change in monthly headache frequency for patients on dual-CGRP regimen.

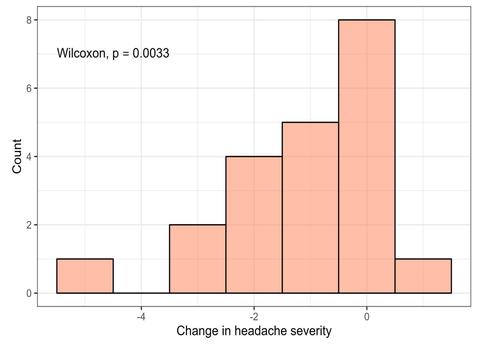

Figure 3. Distribution of change in headache severity for patients on sequential CGRP regimen.

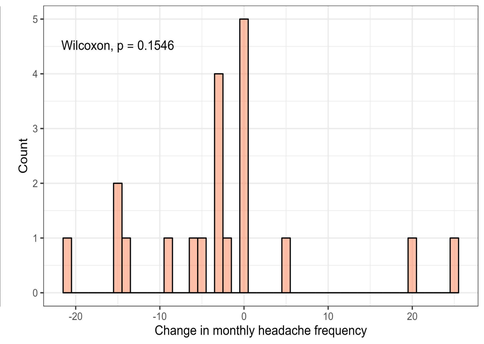

Figure 4. Distribution of change in monthly headache frequency for sequential CGRP regimen.

	Change in headache frequency		Change in headache severity	
Characteristic	**N = 67[1]**	**p-value[2]**	**N = 67[3]**	**p-value[2]**
sex		0.4		0.4
Male	-3.5 (-11.3, 0.0)		-1.00 (-1.00, 0.00)	
Female	-2.0 (-5.0, 0.0)		-1.00 (-3.00, 0.00)	
botox		0.5		0.6
No	-3.0 (-5.0, 0.0)		-1.00 (-2.00, 0.00)	
Yes	0.0 (-8.5, 0.0)		-1.00 (-3.00, 0.00)	
adverse		0.6		0.5
No	-2.0 (-5.0, 0.0)		-1.00 (-2.00, 0.00)	
Yes	-4.0 (-15.0, 0.0)		-2.25 (-4.88, 0.00)	
drug_combination		0.4		>0.9
Combination	-2.5 (-10.3, 0.0)		-1.00 (-3.00, 0.00)	
Receptor antagonists	-1.5 (-3.3, 0.0)		-1.00 (-2.00, 0.00)	
Monoclonal antibodies	-4.0 (-4.0, -4.0)		-1.00 (-1.00, -1.00)	

[1]headache_freq_diff: Median (IQR)

[2]Wilcoxon rank sum test; Kruskal-Wallis rank sum test

[3]headache_sev_diff: Median (IQR)

Table 1. Summary of patient and treatment characteristics by change in headache frequency and headache severity for dual-CGRP regimen.

- **Dual-CGRP (Figure 1&2)**:
  - 51% of patients had an average reduction of 1.40 in headache severity (***p* = 4.4 x 10^{-6}**) while 57% had an average reduction of 5 days in monthly headache frequency (***p* = 1.4 x 10^{-6}**).
- **Sequential CGRP (Figure 3&4)**:
  - 57% of patients had an average reduction of 1.07 in headache severity (***p* = 0.0033**) while the change in headache frequency was not significant with an average reduction of 2 days.
- **Both groups**:
  - The reported adverse events were generally mild including fatigue, constipation, and drowsiness. No significant adverse events reported.
  - Sex, age, the use of onabotulinumtoxinA, or drug combination did not significantly affect changes in monthly headache frequency or headache severity.
  - There was no significant difference in treatment outcomes between patients on two preventative CGRP regimens and patients on both acute and preventive regimens.

Conclusions/Discussion

- **Conclusions**:
  - Significant decreases in headache severity and frequency, without significant adverse events, in patients on the dual-CGRP regimen indicate the safety and beneficial effect of being on a dual-regimen.
  - Significant decrease in headache severity for patients on the sequential CGRP regimen suggests that being on at least one CGRP medication is beneficial.
  - Decrease in headache severity of sequential group suggests that failure of an initial CGRP may not be an accurate indicator of responsiveness to CGRP medications.
  - Comparing patients on a dual-regimen and those on a sequential regimen supports the idea that being on a dual-regimen could enhance treatment outcomes.
  - The class of the first CGRP inhibitor did not predict treatment outcomes as drug combination type had no significant effects on headache frequency or headache severity.
  - Providers should consider a dual CGRP therapy to better control migraine symptoms given the results in this study.
- **Limitations**:
  - Data subject to bias due to sample size and missing patient-reported values (e.g. race, ethnicity, post-treatment symptoms).
  - Lower level evidence due to the study design
  - Long-term results of CGRP regimens are limited by patient insurance and the novelty of CGRP medications (first approved in 2018)

Future Directions

- Future prospective, double-blind, placebo-controlled study can be conducted to further support our findings.

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Disclosure/Correspondence

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Progression of Parkinson's Disease in Asian and Native Hawaiian and Pacific Islander Populations

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Background

Parkinson's disease (PD) is a neurodegenerative disorder caused by dopaminergic cell death in the basal ganglia of the brain, mainly in the substantia nigra. PD is also characterized by the accumulation of the alpha synuclein (SNCA) protein, which disrupts the process of how dopamine is normally synthesized and used in the brain. The degeneration of dopaminergic neurons and lack of normal dopamine activity causes the motor symptoms seen in PD.

The incidence of PD increases with age and as the disease progresses over time, patients will experience a wide range of motor and non-motor symptoms. Cardinal motor signs of PD involve body rigidity, rest tremors, slowing of movement, and postural instability. Non-motor symptoms such as cognitive impairment, sleep disturbances, mood alterations, and constipation, are usually present at the time of diagnosis and may precede motor symptoms.

PD has been observed to be the most common among Hispanics, followed by Whites, Asians, and Blacks. While there is a fair amount of literature investigating PD in the Hispanic population, a detailed characterization of PD presentation and progression in Asian and Native Hawaiian and Pacific Islander populations (NHPI) has not been well documented.

Objectives

- To investigate the presentation, existing comorbidities, and progression of PD severity amongst patients in Hawai'i
- To identify distinct trends and findings specific to Asian and NHPI populations

Methods

- This retrospective review utilized patient records from the Hawai'i Pacific Neuroscience (HPN) eClinical Works 11e software with a diagnosis of PD from June 18th, 2017 to June 18th, 2022
- Ethnicity categories consisted of Whites, Asians, NHPI, and Other (American Indians, Alaskan Natives, and African Americans)
- Recorded data included: demographics (age, sex, ethnicity, BMI, zip code, marital status, insurance), date of diagnosis, presenting symptoms, Parkinson's medications and dosing at time of diagnosis, current Parkinson's medications and dosing, and comorbidities (hypertension, stroke, diabetes, cancer, dementia, etc.)
- Severity of PD was measured by medication dosage amount and frequency using the Levodopa Equivalent Daily Dosage (LEDD), which was calculated based on a previously published algorithm from a systematic review by Tomlinson et al (2010)
- To evaluate the associations by ethnicity, Fisher's exact test was used for categorical variables and the Kruskal-Wallis rank sum test was used for continuous variables
- Spearman's correlation coefficient was computed to determine the association between LEDD score progression

Results

Table 1. *Characteristics of study participants.*

Characteristic	Overall	White	Asian	NHPI	Other	p-value
n (%)	262 (100%)	126 (48%)	96 (37%)	30 (11%)	10 (4%)	
Age at diagnosis	69	69	71	64	67	0.040
Sex						0.004
Male	137 (52%)	77 (56%)	36 (26%)	18 (13%)	6 (4%)	
Female	125 (48%)	49 (39%)	60 (48%)	12 (10%)	4 (3%)	
BMI	26	27	24	28	26	<0.001
Insurance						0.022
Public	200 (77%)	102 (51%)	70 (35%)	20 (10%)	8 (4%)	
Private	46 (18%)	15 (33%)	20 (43%)	10 (22%)	1 (2%)	
Other/Military	2 (1%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	
Combination	11 (4%)	9 (82%)	2 (8%)	0 (0%)	0 (0%)	

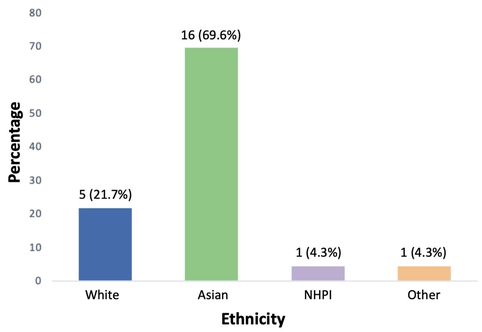

Figure 1. *Dementia illness at time of PD diagnosis by ethnicity.*

- NHPI are diagnosed with PD at a younger age compared to other groups (p=0.040) (Table 1)
- White males and Asian females may have a higher risk of PD (p=0.004) (Table 1)
- 69.6% (n=16) of Asians diagnosed with PD had dementia at the time of diagnosis (p=0.006) (Figure 1)
- 61.0% (n=25) of Whites participated in alcohol consumption at time of PD diagnosis (p=0.017)
- Otherwise, comorbidity characteristics between the groups were similar

- In our study population, the most common presenting symptoms in patients with PD were headaches (74%), dyskinesia (73%), abnormal gait (60%), and blurry vision/diplopia (52%). We found no significant differences in presenting symptoms by ethnicity, indicating PD presentation to be fairly similar for the groups.

- There is a positive correlation between time from PD diagnosis and LEDD score among Asians (p=0.00023) and NHPI (p=9e-04) (Figure 2), demonstrating that PD severity of Asians and NHPI increased the longer the duration of their PD.
- This contrasts with Whites, whose LEDD score did not increase significantly even over a longer duration of disease.

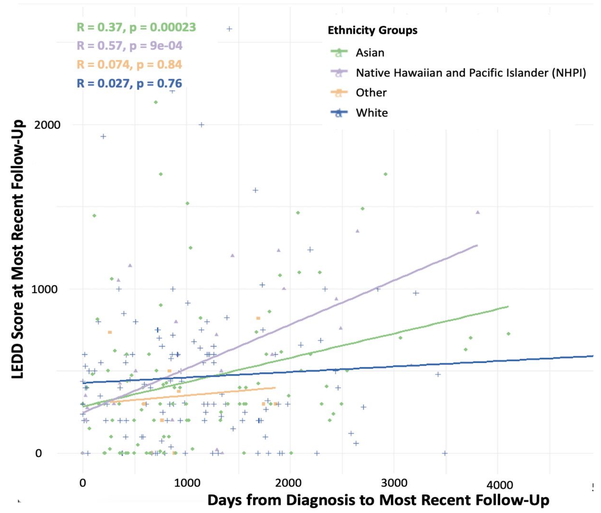

Figure 2. *LEDD score progression by ethnicity.*

Discussion/Conclusions

Our results highlight that NHPI and Asian PD patients require higher medication dosages over time, suggesting a more severe course of disease progression. This may have important implications in the clinical realm, as physicians can be better equipped to manage patient expectations and communicate pertinent information about the probable progression of their PD.

Additional ethnic health disparities were found in PD patients. In our study sample, NHPI were diagnosed with PD at a younger age compared to other groups. These findings align with previous literature that has also identified minority populations to be diagnosed with PD at younger ages compared to Whites. Further research is needed to explore the potential influence of genetic and environmental factors that could be contributing to the onset and progression of PD in minority populations.

Overall, these findings elucidate the need to address the ethnicity-specific differences of PD patients, in which NHPI have an earlier age of diagnosis and a more severe progression of PD compared to other ethnic groups.

There are several limitations to this study. The retrospective nature and small sample size limit the generalizability of our findings, and high dependence was placed on accurate record-keeping and interpretation of patient charts.

Future Directions

Although missing for many of the patients in our study population, investigating the progression of Unified Parkinson's Disease Rating Scale (UPDRS) motor scores and/or the Hoehn Yahr scale may provide further insights into the type of progression found in these PD patient populations. Other future steps in this study could include repeating the analysis with a larger dataset, potentially including patients from other health systems. In addition to ethnic differences in disease progression and severity, sex differences could be explored as well.

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Disclosure/Correspondence

All authors reported no conflicts of interest.

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Sub-Investigators: Jason Viereck, MD, PhD

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