

RESEARCH ARTICLE

Referral Trends Among Veterans Who Report Disruptive Dizziness on the Comprehensive Traumatic Brain Injury Evaluation (CTBIE)

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Aims

Describe referral patterns and consultation completion rates among veterans following the CTBIE.

Methods

We explored the frequency and compliance with recommended follow-up consultations among veterans.. We explored potential predictor variables such as sex, race, ethnicity, dizziness and pain disruption.

Results

Veterans were referred for a “Psychological Disorder”(94.7%), followed by “Pain other than headache”(64.6%) and “Auditory”(67.5%). In general, a high number of consultations were completed (>85%), except for “Substance Abuse” (75%) and “Pain” (53.1, Sex the severity of hearing difficulty, and dizziness severity increased likelihood of a referral.

Conclusions

Veterans with disruptive dizziness completed the majority of the referrals they received. Future research should explore the sensitivity and specificity of the CTBIE and the associated clinical examinations.

Introduction

Post-9/11 veterans have sustained more than half a million traumatic brain injuries (TBIs) over the past two decades.¹ Approximately four out of five of these injuries were classified as mild (mTBI), resulting in symptoms that resolve within a few weeks in the majority of individuals. However, many active-duty service members and veterans frequently report persistent symptoms that last for months and even years following the injury.²⁻⁵ These symptoms often lead to increased disability and inability to complete the functional activities of daily living, as well as difficulty navigating the social responsibilities of daily interactions with colleagues and family members.^{6,7}

Dizziness is consistently identified as a common symptom and a leading factor of persistent disability and discomfort following mTBI in military service members and veterans.^{8,9} Post-injury dizziness is most often attributed to a comorbid vestibular pathology.^{10,11} However, underlying dizziness following a head injury may be the result of other comorbidities.² While dizziness is frequently described as a broad sensation of faintness, lightheadedness and/or wooziness, it can frequently be associated with more debilitating symptoms. For instance, balance disturbances, which can lead to falls, vertigo or the sensation that your surroundings are spinning, and tinnitus, as described by constant ringing in the ears, have a negative effect on veterans' mental health and quality of life.²

Since 2007, the clinical guidelines for treating post-9/11 veterans have recommended completing a Comprehensive Traumatic Brain Injury Evaluation (CTBIE) with a TBI specialist as the initial step in the clinical care pathway for veterans with a history of deployment who experience chronic symptoms and identify a mechanism potentially associated with a previous TBI.¹² The CTBIE considers the level of dizziness experienced by each patient as one of the symptoms assessed during the background interview. The objective of this structured clinical interview is to gather information about the number of symptoms being experienced and their severity, the location and severity of bodily pain, and the intensity of pain-related difficulty in completing daily activities. Moreover, where deemed necessary by the TBI specialist, clinical referrals may be made to a specific specialist within the polytrauma network to assist in further differentiating and treating persistent symptoms. In addition to follow-up assessments requested by the TBI specialist at the time of the CTBIE, patients may also receive additional recommendations for consultations from upstream or downstream subspecialists who identify potential underlying pathologies best treated by an alternative care provider.

While current clinical guidelines allow for patients experiencing persistent symptoms to be referred for follow-up assessments with a wide breadth of specialized providers such as neurologist, audiologist, physical and occupational therapist, social workers, optometrist, speech language pathologist, psychiatrist and others, as seen fit following completion of the CTBIE, little research has explored the manner in which each referral is received and the practical role of the CTBIE in the clinical referral pathway. The lack of information regarding which specialists are typically recommended for referrals and a lack of information about the clinical reasoning behind those referrals limit the current state of evidence-based criteria. These limitations fall short of establishing the rationale necessary to demonstrate the clinical necessity of these referrals in assisting with the differential diagnosis and treatment of a patient's underlying symptomology.

Furthermore, clinical care guidelines fall short of clearly detailing the procedure by which a TBI specialist should make clinical referrals following the CTBIE.

The key factors influencing successful and timely referrals have been previously categorized into three primary domains: (1) patient and injury characteristics, (2) knowledge and beliefs of the service providers and (3) the structural–operational mechanisms of the referral system.¹³ Although the CTBIE is not a core component of head injury clinical care procedures within the Veterans Health Administration and has been completed by more than 150,000 veterans, the extent to which the information gathered during this evaluation is used to make clinical referral recommendations remains largely unexplored. The purpose of the present secondary analysis was to describe referral trends and completed consultations among post-9/11 veterans experiencing dizziness at the time of the CTBIE and to examine referrals received and subsequent completed consultations. Furthermore, we aimed to describe the patient and injury characteristics associated with referrals received to select health care services among veterans experiencing persistent dizziness. We hypothesized that experiencing more severe levels of symptoms commonly associated with the vestibular system (dizziness, difficulty balancing, decreased coordination, trouble hearing) and more severe pain interference at the time of their original CTBIE would lead to an increased chance of receiving a referral and completing a consultation following the CTBIE.

Methods

Original study design and implementation

This study follows results from a larger multifaceted study titled “*Factors associated with outcomes in patients with vestibular symptoms related to TBI*” and its associated survey, titled “*The Analyzing Dizziness Associated with Post-9/11 Veterans with TBI (ADAPT)*”, that aimed to better understand the clinical care of post-9/11 veterans reporting disruptive dizziness following deployment-related TBI and to characterize physical, psychological and audio-vestibular symptoms and care using survey data and medical chart abstraction.^{14,15} The ADAPT survey was developed to address identified gaps in the literature surrounding treatment outcomes for post-9/11 veterans with a suspected TBI, for which dizziness has been reported as a problematic symptom.

Data source and sample

Following local institutional review board approval, post-9/11 veterans were selected using the national Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), and Operation New Dawn (OND) roster file provided by the Veterans Administration (VA) Public Health. The ADAPT study used the national VA inpatient and outpatient dataset merged with the TBI

screening and CTBIE datasets managed by the Office of Patient Care Services. Inclusion criteria for this study were as follows: (1) veterans who received care between fiscal years 2002 and 2016, with (2) at least three years of care during that period, given that (3) two or more of those years occurred in or after 2007.

Identifying patients with disruptive dizziness

To identify the study population of veterans experiencing persistent and disruptive dizziness following a previous mTBI, the original study began by identifying all veterans who had screened positive for TBI and were referred for a CTBIE with a clinical TBI specialist between 2002 and 2016 ($n = 126,365$). For each of those patients, the Neurobehavioral Symptom Inventory (NSI) was reviewed. The NSI consists of four subscales, namely, *vestibular*, *cognitive*, *affective* and *somatic*. The level of symptom disruption is rated using a 5-point Likert scale, ranging from 0 (“does not disrupt activities”) to 4 (“unable to perform at work, school or home due to this problem”) for symptom burden within each subscale. A total vestibular subscore was calculated using the corresponding three items on the NSI (“feeling dizzy”, “loss of balance” and “poor coordination/clumsy”), previously described as vestibular symptoms.¹⁶ The ADAPT study defined *disruptive dizziness* as a summed score of 6 or more based on these three items, which represents an item average of moderate disruption.¹⁷ To identify potential symptom exaggeration, the Negative Impression Management-5 (NIM-5), a scale composed of five unusual symptoms on the NSI, was used.¹⁸ A total of 21,894 patients were identified as experiencing “disruptive dizziness”, among whom 12,511 met the criteria for potential symptom over-reporting. An invitation to participate in the survey and a paper copy of the survey were then sent out to a sample of the remaining 9,383 veterans who qualified and did not meet the criteria for potential symptom over-reporting. The original study groups consisted of (1) those with at least one vestibular dysfunction diagnosis, (2) those with at least one dizziness diagnosis and (3) those with neither diagnosis – so that each group was equally represented and geographically dispersed across the United States. Subsequent reminder requests and paper surveys were sent out until a predetermined saturation threshold of 1,050 participants was reached, which included 350 respondents from each of the original study groups.

Referrals and consultations identified on health service records

To identify relevant referrals and consultations performed by medical providers of interest, the medical health services records of each of the 1,050 participants who responded to the ADAPT survey were abstracted. To start, the key terms (i.e. Audio, Vestib, PM&RS, Physical Therapy, TBI Clinician, TBI, Neuro, Phy, MH, Mental Health, Psy) were used to search for and identify relevant notes that may have indicated a referral to a specialist. The research team then categorized referrals into 10 categories: Psychological

Disorder, Pain, Audiology, Executive Functioning, Migraine/Headache, Sleep, Vision, Vestibular Functioning, Balance and Gait, and Substance Abuse. The categorization was performed by two separate researchers and then compared for consistency. Where disagreement arose, a third reviewer was brought in to help determine the appropriateness of the categorization. In the event that there was no clear indicator of the purpose of the referral or consultation, that visit was withheld from the analysis.

Demographic data

Demographic data in the ADAPT were collected as part of the CTBIE, including age, sex, race, NSI symptoms and level of pain interference. For the present analysis, race/ethnicity categories were regrouped, combining “Asian”, “Native American/Pacific Islander” and “Unknown” into a single category, “Other”, due to the small sample sizes within these groups, which resulted in certain groups having no individuals in these categories, hindering the ability to compare between groups. This resulted in four final race/ethnicity categories: “Black”, “Hispanic”, “Other”, and “White”. Ages were additionally grouped into 10-year ranges from 20 to 60 years and older.

Current study methods and data analysis

For the present study, the initial sample consisted of 1,050 post-9/11 veterans from the original study who completed CTBIE between 2002 and 2016. Of these, 42 participants were excluded as they had missing pain interference data, yielding a final sample of 1,008 veterans. We subsequently examined the number and types of referrals each survey respondent received. For each referral type, descriptive statistics examined the percentage of respondents who received a referral to that specialty and whether a consultation was completed.

Predictor variables were pain interference (e.g. “Not at all” to “Extremely”) and NSI individual items (e.g. “Feeling dizzy”, “Loss of balance”, “Poor coordination, clumsy”, “Hearing difficulties”). Pain interference was measured on Question 18b of the CTBIE where each patient was asked, “In the last 30 days, how much did pain interfere with your life?” and then asked to select 0 – not at all, 1 – mildly, 2 – moderately, 3 – severely or 4 – extremely. For NSI individual items, a reference category was created, combining “None”, “Mild”, and “Moderate” responses into a single group. This was then set as the reference group, “None to Moderately”, due to the original inclusion criteria requiring a total score of 6 or higher on the vestibular subscale.

Following the assessment of each outcome measure for distribution and linearity, two sets of logistic regressions were performed utilizing r (4.5.3). First, logistic regressions were conducted for each of the referral groups of interest (Audiology, Vestibular, Balance and Gait) to investigate any significant associations between potential predictor variables and whether

participants received a referral while controlling for demographic variables (e.g. age, sex, race/ethnicity). Second, logistic regressions were then conducted for the same groups of interest (Audiology, Vestibular, Balance/Gait) to investigate any significant associations between potential predictor variables and whether participants completed a consultation while controlling for demographic variables.

Results

Demographics

The sample consisted of 1,008 post-9/11 veterans ($M_{\text{age}} = 37.2$ years, $SD = 9.97$, range = 27–71 years), with the majority being male (77.1%; $n = 778$) and White (63.6%; $n = 642$). Socio-demographic characteristics are further broken down in [Table 1](#). For clinical characteristics of the sample, the overall average NSI score was 7.45 ($SD = 1.60$) and average reported pain interference was 2.49 ($SD = 1.14$). For further details on clinical characteristics, see [Table 2](#).

Table 1. Socio-demographic characteristics of the veteran sample

Variables	(N = 1,008)
Sex	
Male	778 (77.1%)
Female	231 (22.9%)
Race/ethnicity	
White	642 (63.6%)
Black	157 (15.6%)
Hispanic	135 (13.4%)
Other	75 (7.4%)
Age at CTBIE screen	
Mean (SD)	37.2 (9.97)
Age groups	
20–29	283 (28.0%)
30–39	319 (31.6%)
40–49	274 (27.2%)
50–59	119 (11.8%)
60 and older	14 (1.4%)

Table 2. Clinical characteristics of the veteran sample

Variables	(N = 1,008)
NSI vestibular score	
Mean (SD)	7.45 (1.60)
Feeling dizzy	
Mean (SD)	2.48 (0.76)
None	8 (0.8%)
Mild	41 (4.1%)
Moderate	521 (51.6%)
Severe	340 (33.7%)
Very severe	99 (9.8%)
Loss of balance	
Mean (SD)	2.50 (0.72)
None	0 (0.00%)
Mild	33 (3.3%)
Moderate	536 (53.1%)
Severe	341 (33.8%)
Very severe	99 (9.8%)
Poor coordination	
Mean (SD)	2.47 (0.78)
None	13 (1.3%)
Mild	49 (4.9%)
Moderate	492 (48.8%)
Severe	360 (35.7%)
Very severe	95 (9.4%)
Trouble hearing	
Mean (SD)	2.45 (1.14)
None	70 (6.9%)
Mild	124 (12.3%)
Moderate	293 (29.0%)
Severe	329 (32.6%)
Very severe	193 (19.1%)
Pain interference	
Mean (SD)	2.49 (0.88)
None	15 (1.5%)
Mild	94 (9.3%)
Moderate	404 (40.0%)
Severe	372 (36.9%)
Extreme	124 (12.3%)

Description of referrals for consultations

The total number and types of referrals were calculated for the sample ($M = 6.83$, $SD = 1.94$), with the majority of the sample ranging between five and eight referrals; the distributions of the number of referrals were normal. Only one participant received no referrals at all. [Table 3](#) depicts the number of veterans who received a consultation referral in each of the 10 identified clinical subspecialties. The highest rate of referral was for “Psychological

Disorder”, with approximately 95% of veterans receiving a referral. The next two most frequent referrals were for “Pain other than headache” (68.6%) and “Auditory” (67.5%) assessments. In general, we observed high consultation completion rates exceeding 85% for each of the 10 subspecialties, except for “Substance Abuse” and “Pain”, which had completion rates of 75.0% and 53.1%, respectively.

Table 3. CTBIE-recommended referrals and outcomes for each subspecialty

	Overall (N = 1,008)	Referral outcome	
Psychological disorder			
No referral	53 (5.3%)		
Referral	955 (94.7%)	Completed	918 (96.1%)
		Not completed	37 (3.9%)
Pain			
No referral	317 (31.4%)		
Referral	691 (68.6%)	Completed	367 (53.1%)
		Not completed	324 (46.9%)
Auditory			
No referral	328 (32.5%)		
Referral	680 (67.5%)	Completed	595 (87.5%)
		Not completed	85 (12.5%)
Executive functioning			
No referral	357 (35.4%)		
Referral	651 (64.6%)	Completed	570 (87.6%)
		Not completed	81 (12.4%)
Migraine/headache			
No referral	463 (45.9%)		
Referral	545 (54.1%)	Completed	496 (91.0%)
		Not completed	49 (9.0%)
Sleep			
No referral	566 (56.2%)		
Referral	442 (43.8%)	Completed	403 (91.2%)
		Not completed	39 (8.8%)
Vision			
No referral	600 (59.5%)		
Referral	408 (40.5%)	Completed	358 (87.7%)
		Not completed	50 (12.3%)
Vestibular functioning			
No referral	601 (59.6%)		
Referral	407 (40.4%)	Completed	345 (84.8%)
		Not completed	62 (15.2%)
Balance and gait			
No referral	706 (70.0%)		
Referral	302 (30.0%)	Completed	257 (85.1%)
		Not completed	45 (14.9%)
Substance abuse			
No referral	896 (88.9%)		
Referral	112 (11.1%)	Completed	84 (75.0%)
		Not completed	28 (25.0%)

Factors affecting audiology

REFERRALS RECEIVED

After controlling for demographic variables in the Audiology group, men had significantly higher odds (57% more likely) of receiving a referral. For pain interference, those with moderate pain demonstrated significantly lower odds of receiving a referral compared to those with none to mild, with a 47% lower likelihood, while those with severe pain demonstrated marginally lower odds, with a 40% lower likelihood. For NSI individual items, those who reported severe or extreme dizziness had significantly higher odds of receiving a referral compared to those with none-to-moderate dizziness, being 49% and 93% more likely, respectively. Respondents reporting severe balance difficulty had marginally lower odds (29% less likely) of receiving a referral when compared to those with none-to-moderate difficulty. As expected, trouble hearing was associated with significantly higher odds of receiving a referral at both levels of difficulty, with severe difficulty demonstrating a 112% greater likelihood and moderate difficulty demonstrating a 104% greater likelihood, compared to those with none-to-moderate hearing difficulties. No significant differences were seen for race/ethnicity or any additional NSI items (see [Table 4](#)).

Table 4. Logistic regression predicting whether patients received a referral

(N = 1,008)	Audiology	Vestibular	Balance/gait
	AOR (95% CI)	A	AOR (95% CI)
Sex			
Female	–	–	–
Male	1.57 (1.13, 2.17)**	1.53 (1.10, 2.14)**	1.48 (1.04, 2.14)**
Race			
White	–	–	–
Black	1.27 (0.75, 2.23)	1.32 (0.80, 2.16)	1.02 (0.60, 1.70)
Hispanic	0.89 (0.61, 1.32)	0.66 (0.44, 0.97)**	0.81 (0.54, 1.20)
Other	1.16 (0.77, 1.77)	0.95 (0.64, 1.40)	0.63 (0.40, 0.97)**
Dizziness			
None to moderate	–	–	–
Severe	1.49 (1.08, 2.08)**	1.53 (1.13, 2.07)**	1.07 (0.77, 1.48)
Very severe	1.93 (1.05, 3.65)**	4.02 (2.30, 7.20)***	1.50 (0.85, 2.63)
Balance			
None to moderate	–	–	–
Severe	0.71 (0.51, 1.00)*	1.12 (0.81, 1.54)	0.97 (0.69, 1.36)
Very severe	0.96 (0.50, 1.91)	1.19 (0.63, 2.21)	1.20 (0.64, 2.23)
Coordination			
None to moderate	–	–	–
Severe	0.97 (0.71, 1.34)	0.87 (0.64, 1.17)	1.09 (0.79, 1.49)
Very severe	0.64 (0.37, 1.11)	0.50 (0.28, 0.87)**	0.92 (0.52, 1.60)
Hearing			
None to moderate	–	–	–
Severe	2.12 (1.54, 2.94)***	0.96 (0.71, 1.30)	0.95 (0.69, 1.30)
Very severe	2.04 (1.38, 3.07)***	0.89 (0.61, 1.29)	0.90 (0.61, 1.33)
Pain interference			
None to mild	–	–	–
Moderate	0.53 (0.32, 0.87)**	1.03 (0.66, 1.62)	0.81 (0.51, 1.31)
Severe	0.60 (0.36, 0.99)*	1.12 (0.72, 1.77)	1.26 (0.79, 2.03)
Extreme	0.78 (0.42, 1.46)	0.85 (0.49, 1.48)	1.17 (0.66, 2.07)

* p -value = < 0.05–0.01; ** p -value = 0.01–0.001; *** p -value = < 0.001.

Within the measured population, 67.5% received a referral to see an audiologist, while 40.4% and 30% received referrals for a vestibular therapist and a balance and gait specialist, respectively.

COMPLETED CONSULTATIONS

When predicting whether veterans completed a consultation following the CTBIE with an audiologist, a few significant predictors were identified. Specifically, the odds of completing a consultation significantly decreased in those who reported severe dizziness, demonstrating a 44% lower likelihood than those with none-to-moderate dizziness. Additionally, those who reported extreme loss of coordination were 69% less likely to complete a consultation than those who reported none-to-mild loss. Surprisingly, no significant differences in consultation completion were observed among individuals with greater levels of hearing difficulties. No significant differences were seen for race/ethnicity or any additional NSI items (see [Table 5](#) for consultation results).

Table 5. Logistic regression predicting whether patients completed a consultation

	Audiology (n = 680)	Vestibular (n = 407)	Balance/gait (n = 302)
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Sex			
Female	–	–	–
Male	0.78 (0.39, 1.45)	0.81 (0.34, 1.75)	1.66 (0.70, 3.77)
Race			
White	–	–	–
Black	1.14 (0.49, 3.13)	1.91 (0.68, 6.85)	0.68 (0.21, 2.82)
Hispanic	1.14 (0.57, 2.45)	2.10 (0.83, 6.48)	0.46 (0.19, 1.17)*
Other	0.99 (0.51, 2.04)	2.34 (0.87, 8.21)	0.75 (0.26, 2.57)
Dizziness			
None to moderate	–	–	–
Severe	0.56 (0.32, 0.95)**	1.07 (0.54, 2.13)	0.93 (0.41, 2.14)
Very severe	1.02 (0.38, 3.09)	0.82 (0.32, 2.17)	1.03 (0.30, 3.86)
Balance			
None to moderate	–	–	–
Severe	1.19 (0.66, 2.16)	0.58 (0.28, 1.18)	1.66 (0.69, 4.17)
Very severe	1.68 (0.58, 5.35)	0.56 (0.19, 1.77)	2.24 (0.52, 10.7)
Coordination			
None to moderate	–	–	–
Severe	0.62 (0.36, 1.06)	0.71 (0.37, 1.37)	0.51 (0.22, 1.19)
Very severe	0.31 (0.13, 0.79)**	0.60 (0.21, 1.83)	0.35 (0.09, 1.38)
Hearing			
None to moderate	–	–	–
Severe	1.10 (0.65, 1.88)	0.63 (0.32, 1.24)	1.56 (0.65, 3.94)
Very severe	1.28 (0.67, 2.53)	0.63 (0.29, 1.40)	0.34 (0.14, 0.82)**
Pain interference			
None to mild	–	–	–
Moderate	0.89 (0.38, 1.91)	0.51 (0.16, 1.36)	0.29 (0.04, 1.18)
Severe	0.85 (0.36, 1.82)	1.01 (0.31, 2.85)	0.45 (0.07, 1.83)
Extreme	1.44 (0.51, 4.12)	1.01 (0.26, 3.68)	0.11 (0.01, 0.49)**

p*-value = < 0.05–0.01; *p*-value = 0.01–0.001; ****p*-value = < 0.001.

Within the measured population, 87.5% who received a referral to see an audiologist actually completed the consultation. Meanwhile, 84.8% and 85.1% of those who received referrals for a vestibular therapist and a balance and gait specialist, respectively, completed those consultations.

Factors affecting vestibular consultation

REFERRALS RECEIVED

After controlling for demographic variables in the vestibular group, men were significantly more likely to receive a referral (53% more likely) for a vestibular assessment. Furthermore, those who were Hispanic were 34% less likely than other racial/ethnic groups to receive a referral. For NSI individual items, those who reported severe (53% more likely) or extreme (302% more likely) dizziness had significantly higher odds of receiving a referral compared to those with none-to-moderate dizziness. Respondents reporting extremely poor coordination were 50% less likely to receive a referral when compared to other difficulty groups. No significant differences were seen for pain interference or any additional NSI items (see [Table 4](#)).

COMPLETED CONSULTATIONS

When predicting whether veterans completed a consultation with a vestibular specialist following the CTBIE, we found no significant predictors. Furthermore, no significant differences were seen for race/ethnicity, sex, pain interference or any additional NSI items.

Factors affecting balance and gait consultation

REFERRALS RECEIVED

For race/ethnicity, those included in the Other category were 63% significantly less likely to receive a referral (adjusted odds ratio (AOR) 0.63; 95% confidence interval (CI): 0.40, 0.97; $p = 0.039$). No significant differences were seen for pain interference or any NSI items (see [Table 4](#)).

COMPLETED CONSULTATIONS

Consistent with findings for the other two groups, few variables significantly predicted whether veterans completed a consultation with a balance and gait specialist following the CTBIE. We identified only two significant predictors. First, the odds of completing a consultation were significantly lower for individuals reporting extreme dizziness (89% less likely) than those reporting none-to-moderate dizziness. Interestingly, the second predictor consisted of individuals who reported extreme hearing difficulty, who were 66% less likely to complete a consultation than those who reported none-to-moderate hearing difficulty. No significant differences were seen for sex, race/ethnicity, pain interference or any additional NSI items (see [Table 5](#)).

Discussion

The primary aim of the present study was to describe the referrals for health care services received by veterans suffering from disruptive dizziness. Within our sample of veterans, a referral for a consultation with a psychological disorder was the most prevalent referral (94.7%), followed by referrals for

an audiologist 67.5%) and a consultation related to executive functioning (64.6%). This is in alignment with previous evidence of high levels of correlation between veterans with persistent dizziness and psychological conditions such as post-traumatic stress disorder, depression, sleep disturbances and cognitive impairment.^{4,19-21} It is interesting to note that despite numerous reports of the benefit of rehabilitation services to treat comorbid vestibulopathy among veterans suffering from disruptive dizziness following a suspected head injury, only a third of the veterans in our population received a referral to a vestibular specialist and a quarter received a referral for a consultation with a balance and gait expert. Although determining whether a higher percentage of individuals in the study population would have benefited from a consultation with a vestibular physical therapist and/or a balance and gait specialist is outside the nature and scope of a cross-sectional retrospective review of medical records, several published reports have demonstrated the benefits of targeted therapy to address vestibulopathy in patients suffering from persistent dizziness.^{11,22,23}

Consistent with our hypothesis, the present study explored the contribution of select component factors related to our patient population to the likelihood of receiving a referral for a specialist consultation following the CTBIE. We hypothesized that experiencing more severe levels of symptoms and more severe pain interference at the time of the CTBIE would lead to an increased chance of receiving a referral and completing a consultation following the CTBIE. Our hypothesis was based on previously reported benefits of rehabilitation services geared towards treating comorbid vestibulopathy among concussion patients suffering from dizziness, suggesting that the TBI specialist performing the CTBIE may view that those with more extreme symptoms may benefit the most from a referral. We focused our analysis on three select referral categories, namely audiologist, vestibular therapist and balance and gait consultation.²³ Within our sample, men were more likely to receive a referral for each of the three explored specialties, but sex played no role in the likelihood of completing a consultation following a referral. While not explored directly in our analysis, this finding could be due to several factors, such as provider bias and/or differential symptom presentation. Although little previous research has explored whether or not male patients receive more referrals than female patients, there have been multiple studies suggesting that male patients are more likely to receive a diagnosis than female peers. In combination, these findings may suggest that male patients may be more likely to receive a diagnosis based on the number of referrals received.

In exploring the role that dizziness severity and pain interference at the time of CTBIE, as well as other demographic factors, played in referral patterns and completion of a consultation with the referred providers, we identified multiple interesting findings. For instance, related to consultations with an audiologist, the likelihood of having received a referral with an

audiologist was predicted by sex, the severity of hearing difficulty, those who reported severe and extreme dizziness, and those who reported moderate pain interference. Similarly, in our veteran population, men with severe or extreme dizziness at the time of CTBIE were more likely than those with moderate dizziness to have a consultation with a vestibular therapist, while Hispanics were less likely to receive a referral. The finding that those with severe coordination loss were less likely to complete a consultation following a referral than those with mild-to-moderate coordination loss is counter-intuitive and perhaps an indicator of alternative issues. For instance, did those with more severe balance disruption encounter greater barriers in completing a consultation, such as transportation or symptom avoidance behaviours? These findings are in agreement with previous findings, suggesting that sex, race, age and the severity of symptomology are leading predictors of health service utilization.¹³

The observed discrepancy between the number of individuals receiving referrals for therapeutic intervention with a manual therapist and the documented benefits associated with those interventions represents a clear gap in the understanding the clinical management of veterans with persistent symptoms resulting from a suspected head injury. Future research may focus on the potential benefit of including additional clinical assessments into the CTBIE that are sensitive to the differential diagnosis of persistent vestibular symptoms. For instance, assessments such as the VOMS 2, Dix–Hallpike manoeuvre, caloric test, sensory organization test may assist TBI specialists in identifying those who would most benefit from referrals to vestibular and manual therapists.

It should be noted that, although the sample represents a large, nationally representative cohort of veterans and the NIM-5 was utilized to identify potential over-reporting of symptoms, some limitations persist. For instance, the present study is a cross-sectional retrospective design that relied heavily on chart abstraction; consequently, referrals that not documented may have been missed. Moreover, there is a possible selection bias from survey non-response and a lack of clinical outcome data. Therefore, while the researchers were able to have an idea of what referrals were given and then completed, we don't know anything about consultations resulting in symptom improvement. Lastly, care in the Veterans Health Administration is widely different from the care those in the private sector may receive, and therefore the generalizability may be limited to veterans meeting NSI criteria for disruptive dizziness without evidence of symptom over-reporting.

Conclusions

The findings of the present study underscore the need to better understand the patient characteristics associated with both referrals received and the resulting consultation from that referral. Moreover, it is critical to also explore the perceived beliefs and perceptions of those TBI specialists who make the

referrals for consultation with various health service providers among veterans experiencing disruptive dizziness. While the present study design allows for a thorough description of referral practices among veterans with a history of a suspected TBI, its retrospective, cross-sectional design makes it difficult to understand what led to certain referrals and what component factors related to the patient and/or the providers' beliefs might have contributed to a veteran receiving a follow-up referral while others were not. Future research should utilize mixed-methods and prospective study designs to explore the patient characteristics associated with select referrals for health services in veterans experiencing persistent dizziness. Moreover, it would be critical to consider the knowledge and beliefs of the TBI specialist as well as the context and operational mechanisms of the clinical care pathways for veterans completing a CTBIE.

Summary points

- Total number and types of referrals were calculated for each veteran in the sample ($M = 6.83$, $SD = 1.94$), with the majority of veterans reporting disruptive dizziness receiving between five and eight referrals for subsequent specialist consultations.
- Veterans were most frequently referred for a “Psychological Disorder” (94.7%), followed by “Pain other than headache” (64.6%) and “Auditory” (67.5%).
- In general, a high rate of consultations was completed (> 85%), except for “Substance Abuse” (75%) and “Pain” (53.1).
- The findings of the present study illustrate the need to better understand the patient characteristics associated with both referrals received and subsequent consultation completion.
- Future research should utilize mixed-methods and prospective study designs to explore the patient characteristics associated with select referrals for health services in veterans experiencing persistent dizziness.

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Data availability statement

The deidentified data supporting the inferences of this article will be made available by the authors, upon completion and approval of required VA data sharing agreements.

Conflict of interest

None

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