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Assessment of the Cost Burden of Episodic Recurrent Vestibular Vertigo in the US

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IMPORTANCE Understanding of the economic burden of recurrent vestibular causes of vertigo and areas contributing to the cost is needed.

OBJECTIVE To analyze and identify the factors contributing to the direct medical costs associated with Ménière disease (MD), vestibular migraine (VM), and benign paroxysmal positional vertigo (BPPV).

DESIGN, SETTING, AND PARTICIPANTS This economic evaluation used MarketScan Commercial Database claims data from 2018 to identify the non-Medicare patient population with the diagnoses of MD, VM, or BPPV. Data were analyzed January 1 to December 31, 2018.

MAIN OUTCOMES AND MEASURES The total direct medical costs associated with MD, VM, and BPPV.

RESULTS A total of 53 210 patients (mean [SD] age, 47.8 [11.8] years; 67.6% female) were included in this study, with 34 738 normal comparisons. There were 5783 (10.9%) patients with MD, 3526 (6.6%) patients with VM, and 43 901 (82.5%) patients with BPPV in the data set. Mean age and sex were different across the different vestibular disorders. Across the different groups, patients with no comorbidities or with a Charlson Comorbidity Index score of zero ranged from 98.4% to 98.8%. Around 5% of patients were hospitalized with inpatient stay lasting between 4.6 and 5.2 days. After adjusting for age, sex, and comorbidities, there were large differences in mean adjusted annual payments/direct costs across the different groups (MD, $9579; VM, $11 371; and BPPV, $8247). This equated to a total incremental estimated cost of $60 billion compared with the normal population. The number of outpatient brain magnetic resonance imaging or computed tomography scans per patient ranged anywhere from 1 to 20, while the number of inpatient brain magnetic resonance imaging or computed tomography scans per patient ranged anywhere from 1 to 6. A heat map of the total cost expenditure indicated that the costs were concentrated around the Midwest, Lake Michigan, and the East Coast.

CONCLUSIONS AND RELEVANCE In this economic evaluation, the 3 most common causes of recurrent vertigo—MD, VM, and BPPV—had considerable medical costs associated with them. Extraneous imaging orders and vestibular testing are factors to consider for cost reduction. However, further research and widespread education is needed to optimize the diagnosis, treatment, and care of patients presenting with vestibular disorders or dizziness.

Supplemental content

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Dizziness is a term used to describe a range of sensations that leads to an impairment of spatial orientation or balance. Patients most commonly use descriptors such as feeling faint, woozy, weak, or unsteady. Vertigo, in particular, is an illusion of movement that is often related to problems with the inner ear and accounts for approximately 25% of patients with dizziness.[1,2] The 3 most common episodic vestibular disorders that cause vertigo are benign paroxysmal positional vertigo (BPPV), vestibular migraine (VM), and Ménière disease (MD).[3,4] Benign paroxysmal positional vertigo is present in approximately 20% to 30% of diagnoses in dizziness clinics.[5-7] Ménière disease is present in approximately 13% of patients referred to dizziness clinics.[7] Vestibular migraine could be present in up to 23.4% of patients with dizziness.[8] Altogether BPPV, VM, and MD seem to account for about 50% of patients presenting to the clinic for dizziness. These disease processes are known to severely affect essential activities of daily living, quality of life, work, and social interactions.[9-11] All of these factors can lead to considerable direct and indirect costs for the individuals experiencing it.

The current landscape in assessing the economic burden of patients with dizziness and vertigo is quite limited even though dizziness affects 15% to approximately 30% of adults.[1,12,13] A 2020 study by Ruthberg et al[12] found that the total annual medical expenditures for patients with dizziness or vertigo was $48.1 billion in the US, which was estimated based on direct medical costs alone. Often, indirect costs such as work attendance, productivity, and disability benefits might go unnoticed or with little consideration. A 2014 study by van der Zaag-Loonen and van Leeuwen[14] showed that half of the patients referred to a tertiary center for dizziness reported work absenteeism owing to dizziness, and 12% reported being completely disabled to work. Furthermore, a study from the United Kingdom estimated that indirect costs for MD accounted for 88% of the total cost.[15] It is clear that dizziness and vertigo can lead to considerable economic burden for individuals and for society as a whole. Understanding the magnitude of direct costs in specific vestibular diagnoses may justify interventions that could possibly lead to cost-reduction measures.[16,17] Improved clinical reasoning, quicker diagnosis, and adequate treatment should lead to reduced work absenteeism, increased productivity, and ultimately reduced disability, which are all contributors to the indirect costs and to societal burden. This economic evaluation uses a nationally representative sample to characterize and analyze the economic burden associated with the direct cost of the 3 most common, episodic vestibular causes of dizziness: BPPV, VM, and MD.

Key Points

Question Can the direct medical costs associated with the principal causes of episodic recurrent vertigo in the non-Medicare population be quantified?

Findings This economic evaluation of patients with benign paroxysmal positional vertigo, vestibular migraine, or Ménière disease found that there was an incremental increase in cost of $2087 to $5211 per person per year compared with the normal population, amounting to a total annual increase in cost to society of $60 billion.

Meaning Episodic vestibular disorders account for considerable medical expenditures, and further research and education are needed to optimize management and to reduce costs.

Methods

Patient Population and Study Design

MarketScan Commercial Database (IBM) claims data from January 1 to December 31, 2018, for privately insured individuals were used to identify those diagnosed with BPPV, MD, and VM. We extracted data on a cohort of patients aged 0 to 64 years with an *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision* code for dizziness (R42), BPPV (codes H81.11, H81.12, H81.13, and H81.10), MD (codes H81.01, H81.02, H81.03, and H81.09), and migraine/migraine equivalent (codes G43.109, G43.839, G43.829, G43.119, G43.011, G43.019, G43.009, G43.911, G43.919, G43.901, G43.909, G43.401, and G43.409). Code R42 was used as a companion code to the migraine codes to determine VM because no standalone *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision* code for VM exists. Code R42 was also used as an exclusion code for selecting the normal comparisons group. Because this study used deidentified data from a claims database, institutional review board approval and patient informed consent were not required.

For this study, only the first recorded diagnosis code was used to classify patient groups (except for VM). If there were multiple codes used in the same visit, then it was assumed that the first recorded diagnosis code was considered the primary diagnosis. Common computed tomography (CT)/magnetic resonance imaging (MRI) scans, such as CT of the head and temporal bones and MRI of the brain and posterior fossa cuts, were identified among the groups using codes 70450, 70460, 70470, 70480, 70481, 70482, 70551, 70552, and 70553.

Once classified into a specific diagnostic group, all subsequent records were used to determine the direct cost of illness burden. We compared the 3 separate diagnosis groups with a normal comparisons group with none of the diagnosis codes for dizziness, vertigo, or vestibular pathologies. Analysis was controlled for baseline age, sex, Charlson Comorbidity Index (CCI) score,[18] use of CT/MRI scans, estimate-adjusted total payments, hospital length of stay, and hospital admissions. The CCI is a weighted index that captures both the number and seriousness of comorbid disease, and CCI scores of 1 to 2 are mild (10-year survival, 90%-96%), 3 to 4 are moderate (10-year survival, 54%-77%), and 5 or greater are severe (10-year survival, <21%).[19]

Statistical Analysis

Descriptive statistics were calculated comparing all groups and then comparing each group to another. No adjustment for multiple comparison was applied to these descriptive data. Total

Table 1. Overall Characteristics of the Study Populations

Characteristic	No. (%)			
	Ménière disease (n = 5783)	Vestibular migraine (n = 3526)	Benign paroxysmal positional vertigo (n = 43 901)	Normal comparisons (n = 34 738)[a]
Age, mean (SD), y	50.4 (10.5)	39.1 (12.3)	48.2 (11.6)	42.0 (13.5)
Sex				
Female	3552 (61.4)	2903 (82.3)	29 534 (67.3)	18 833 (54.2)
Male	2231 (38.6)	623 (17.7)	14 367 (32.7)	15 905 (45.8)
Charlson Comorbidity Index score				
0	5713 (98.8)	3472 (98.5)	43 326 (98.7)	34 169 (98.4)
1	38 (0.7)	30 (0.9)	304 (0.7)	272 (0.8)
≥2	32 (0.5)	24 (0.6)	271 (0.6)	297 (0.8)
Patients with hospital admissions	272 (4.7)	214 (6.1)	1773 (4.0)	1510 (4.3)
Hospital days, mean (SD)	4.6 (6.9)	5.2 (8.6)	4.9 (8.7)	5.0 (9.5)

[a] Randomly selected patients with no diagnosis codes for dizziness.

payments were estimated by combining payments for outpatient, inpatient, and pharmacy claim amounts at the individual patient level. Total payments were compared across diagnosis groups using γ-distributed, generalized, linear log-linked models, adjusting for baseline covariates (age, sex, and CCI score). These models reported mean values with 95% CIs to describe the magnitude of difference and uncertainty of estimates. All analyses were performed using SAS, version 9.4 (SAS Institute Inc).

Results

Overall Characteristics

In this study, there was a total of 5783 patients with MD, 3526 patients with VM, and 43 901 patients with BPPV, along with 34 738 normal comparisons (**Table 1**). Mean age was similar across the groups. There was a greater proportion of female patients with VM (n = 2903 [82.3%]) compared with the other conditions. For each clinical group and the normal comparisons group, the majority of patients had CCI scores of 0. There was no meaningful difference in the proportion of patients in each clinical group and normal comparisons who had CCI scores of 2 or greater. The number of patients who were hospitalized across the different groups ranged from 214 to 1773 (4.0%-6.1%) patients with hospital durations ranging from 4.6 to 5.2 days.

Direct Payment Costs

The breakdown of different payment costs that were calculated is summarized in **Table 2**. These represent payments to health care professionals before application of coordination of benefits, copayments, and deductibles, and do not reflect actual cost to the patients. Mean annual payment accounted for hospital, outpatient, and prescription payments. Total cost for MD and VM were equivalent but still higher than the cost for BPPV. After adjusting for age, sex, and comorbidities, there were statistically significant differences in the mean (range) adjusted annual payment between each group: the VM group had the highest cost ($11 371 [$10 872-$11 894]) followed by MD ($9579 [$9250-$9920]) and BPPV ($8247 [$8143-$8354]). All 3 vestibular groups had statistically significantly higher mean (range) cost compared with the normal population ($6160 [$6071-$6250]). Outpatient payments constituted the majority of the cost (approximately 65%).

The total direct cost payments of MD, VM, BPPV, and normal comparisons over a 12-month period are summarized in **Table 3**.[5,8,20] Results were calculated based on adjusted annual cost and number of patients analyzed in each diagnosis group (ie, for MD there were 5783 patients with a mean adjusted annual cost of $9579, which equates to $55.4 million). The extrapolated yearly payment in the US was calculated based on the adjusted annual cost and expected number of US population with each diagnosis. For example, for MD, the prevalence is expected to be 0.2% of the US population, which equates to 0.66 million people with a mean adjusted cost of $9579 per person, resulting in $6.3 billion in payment. These results indicate that in the US, the total payment cost of the 3 vestibular diagnoses—MD, VM, and BPPV—is estimated to be about $151 billion.

Table 3 also summarizes the incremental increase in cost for each vestibular diagnosis compared with the normal comparison population, which was calculated based on difference in adjusted annual payment (each vestibular diagnosis vs control). The extrapolated total cost of payment in the US was calculated using the same process as the total payment cost. There was a total incremental increase in payment cost of approximately $60 billion compared with that of the normal population.

Imaging

Results for inpatient vs outpatient scans are summarized in **Table 4**. Total number of inpatient scans ranged from 21 to 247 (0.3%-1.2%) across the different groups, while the total number of outpatient scans ranged from 914 to 6841 (2.6%-37.2%). For inpatient scans, the number of scans performed per patient ranged anywhere from 1 to 6 across the different diagnoses. For outpatient scans, the number of scans per-

Table 2. Mean Cost of Payment to Clinicians per Person in Dollars

Payment	Ménière disease	Vestibular migraine	Benign paroxysmal positional vertigo	Normal comparisons
Annual payment[a]				
No.	5783	3526	43 901	34 738
Mean (95% CI), $	11 036 (10 641-11 445)	10 894 (10 397-11 414)	9507 (9382-9633)	7069 (6965-7175)
Adjusted annual payment[b]				
No.	5783	3526	43 901	34 738
Mean (95% CI), $	9579 (9250-9920)	11 371 (10 872-11 894)	8247 (8143-8354)	6160 (6071-6250)
Hospital payment				
No.	272	214	1773	1510
Mean (95% CI), $	36 672 (32 745-41 071)	29 345 (25 826-33 342)	38 225 (36 566-39 960)	35 638 (33 965-37 394)
Outpatient payment				
No.	5756	3506	43 641	34 455
Mean (95% CI), $	7437 (7186-7698)	7363 (7046-7695)	6117 (6041-6194)	3946 (3891-4002)
Prescription payment				
No.	5090	2996	37 520	27 134
Mean (95% CI), $	2168 (2064-2278)	2109 (1977-2249)	2202 (2162-2242)	2028 (1985-2072)
Scan payment for patients with scans[c]				
No.	968	1283	6686	890
Mean (95% CI), $	1329 (1252-1411)	1161 (1103-1223)	1178 (1151-1205)	1106 (1040-1178)

[a] Hospital payment plus outpatient payments plus scan payments.

[b] Adjusted for age, sex, and comorbidities; true difference between different diagnosis; and removed costs associated with patients' personal characteristics.

[c] Inpatient scans and outpatient scans.

Table 3. Total Clinician Payments in Millions of Dollars and Incremental Increase in Cost of Illness for the Conditions in Study and to the US as a Whole

Payment	Ménière disease	Vestibular migraine	Benign paroxysmal positional vertigo	Normal comparisons
Total payments in 2018 (based on adjusted cost), $ (millions)[a]	55.4	40.1	362.1	214.0
Extrapolated total payment in the US				
Prevalence, %[b]	0.2	2.7	1.6	NA
No. (millions)[c]	0.66	8.9	5.3	NA
Yearly payment (based on adjusted cost), $ (billions)	6.3	101.2	43.7	NA
Incremental increase in payment to clinicians compared with normal population, $	3419	5211	2087	NA
Extrapolated total cost of payments for the US population, $ (billions)[a]	2.3	46.4	11.0	NA

Abbreviation: NA, not applicable.

[a] Calculated based on adjusted annual cost and total number for each diagnosis.

[b] Based on literature by von Brevern et al,[5] Formeister et al,[8] and Alexander and Harris.[20]

[c] Calculated based on the total US population reported by the US Census Bureau in 2020.

formed per patient ranged anywhere from 1 to 20. In the outpatient setting, patients received scans at a much higher rate compared with the normal population, especially patients with VM (1310 [37.2%] vs 914 [2.6%]). Additionally, patients with VM and BPPV had a noticeably higher maximum number of scans completed per patient compared with patients with MD.

US Heat Map of Cost for BPPV, MD, and VM

The total cost of BPPV, MD, and VM across the US at the state level can be seen in the **Figure**, along with marked locations of dizziness and balance centers at academic institutions supplied by the Vestibular Disorders Association. The eFigure in the Supplement provides a heat map for outpatient costs only. When looking at regions associated with the upper half of the cost index (≥$10 000), there are 3 primary areas of concentration. The first area is in the Midwest, specifically at the intersection between the west, midwest, and southwest regions, such as Wyoming, Nebraska, Colorado, Kansas, Oklahoma, and Texas. The second area of concentration is the states surrounding Lake Michigan. The last area of concentration seems to run along the southern and eastern coasts, from Florida up to Maine. Additional states outside of those areas also show a high-cost index; however, in general, the areas mentioned consistently had the highest cost index across all 3 diagnoses.

Table 4. Inpatient vs Outpatient Scans

Scans	Inpatient scans				Outpatient scans			
	Ménière disease	Vestibular migraine	Benign paroxysmal positional vertigo	Normal comparisons[a]	Ménière disease	Vestibular migraine	Benign paroxysmal positional vertigo	Normal comparisons[a]
Total No. (%)	21 (0.4)	43 (1.2)	247 (0.6)	106 (0.3)	976 (16.9)	1310 (37.2)	6841 (15.6)	914 (2.6)
No. per patient, mean (SD) [range]	1.00 (0) [1-1]	1.19 (0.45) [1-3]	1.21 (0.57) [1-6]	1.14 (0.45) [1-4]	1.92 (1.10) [1-8]	1.93 (1.32) [1-20]	2.07 (1.26) [1-19]	2.00 (1.28) [1-18]

[a] Randomly selected patients with no diagnosis codes for dizziness.

Discussion

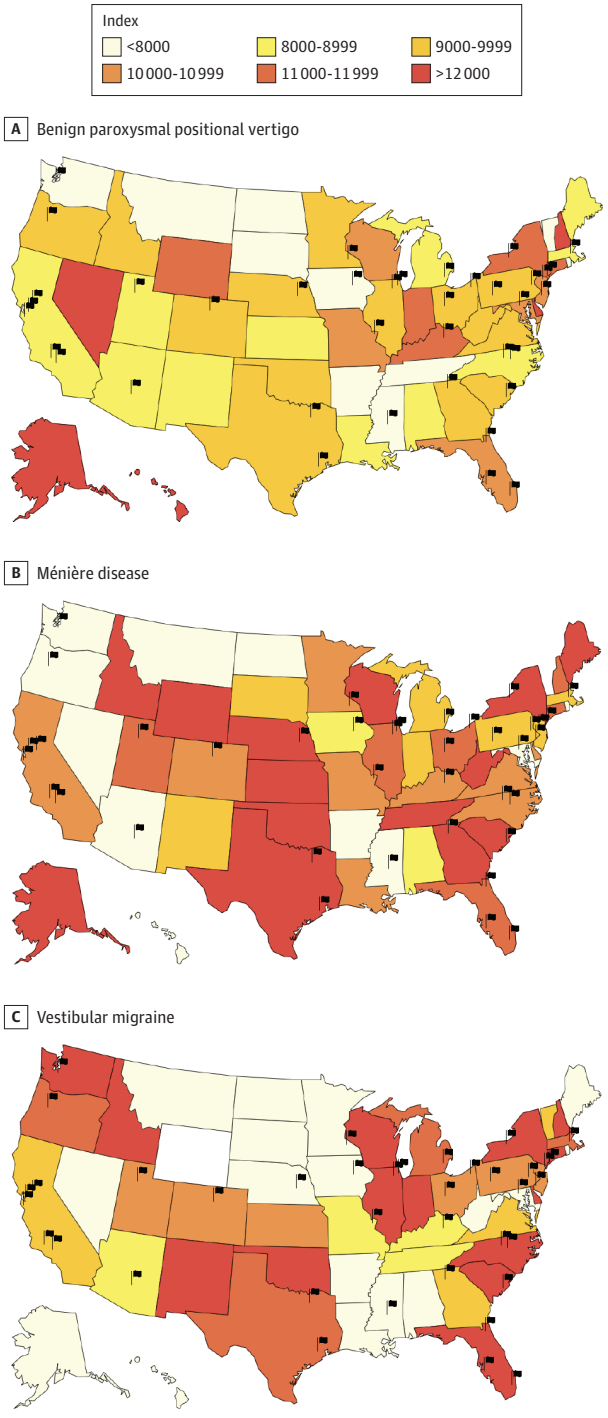
This study quantified and analyzed the direct costs associated with the most common causes of episodic recurrent vestibular vertigo in the US. We found that, on average, payment costs for treating patients were $2087 to $5211 higher compared with treating patients without dizziness, after controlling for various demographic and comorbidity factors. This equated to a 1.34- to 1.85-fold annual incremental increase in the payment costs associated with these vestibular diagnoses. A 2020 study published by Ruthberg et al[12] also agreed with these findings, reporting a 1.38-fold annual incremental increase in cost for treatment of patients with vertigo and dizziness in the US. Population-based epidemiologic studies suggest that dizziness affects about 15% to 20% of adults yearly.[1,13] Vestibular vertigo, in particular, seems to have a 1-year prevalence of 5% in the general population.[1] Ménière disease, VM, and BPPV have a 1-year prevalence of approximately 0.2%, 2.7%, and 1.6%, respectively.[5,8,20] Altogether, the 3 most common causes of vestibular vertigo have a 1-year prevalence of approximately 4.5%. Using that prevalence rate and extrapolating the yearly payment found in the present study to the US population as a whole, there is an approximate $151 billion cost to society associated with these 3 diagnoses. There is an annual incremental increase in cost to society of about $60 billion in medical expenditures associated with this subset of the population compared with an equivalent healthy patient population. Thus, these findings align with those reported in previous literature and highlight the considerable costs associated with episodic recurrent vertigo due to vestibular disorders.

In addition to frequent outpatient and emergency department visits, imaging costs were one of the main causes of inflated expenditures. This study population consisted of adults without Medicare and with little to no comorbidities, yet results showed that patients with vestibular diagnoses have increased rates of outpatient scans (7-8 times higher) compared with the normal population. Patients with VM had twice the number of scans compared with the other vestibular diagnoses, which indicates that these patients are being overexposed to imaging costs. This is important because MD, VM, and BPPV are purely clinical diagnoses with no radiological or paraclinical criteria for diagnosis (except for audiogram in MD).[21-23] Even if some scans were completed as a workup for MD, in the context of an asymmetric hearing loss, typical MD with low-frequency hearing loss rarely requires an MRI. Furthermore, in such scenarios, it rarely leads to a diagnosis of retrocochlear pathology. Although patients with vertigo are likely to undergo imaging to rule out posterior fossa strokes, CT and MRI have limited clinical use in evaluating dizziness and no use in the diagnosis of the vestibular disorders described in this study.[24-26] A study by Ahsan et al[26] highlights this by reporting that 48% (n = 807) of patients who presented to the emergency department with dizziness received neuroimaging, and only 0.74% of those scans yielded clinically significant pathologies.

Furthermore, the total cost associated with those 807 patients was nearly $1 million.[26] It is possible, then, that the extraneous scans performed in this patient population are likely contributing meaningfully to this population's substantial medical costs. However, repeated brain imaging in patients with likely stereotypical clinical presentation suggests a potential misunderstanding of those pathologies, especially VM, which is often underdiagnosed according to a recent consensus expert panel from the Association of Migraine Disorders.[27] In addition, MD, VM, and BPPV are benign disorders that can lead to symptoms such as severe vomiting and dehydration that may require hospitalization, which further contributes to the increase in cost. Overlap between MD and VM can also make it difficult to differentiate the 2. Comorbid BPPV with MD and VM further add to the confusion of the clinical presentation in the absence of appropriate training.[28,29] As a result, these resulting uncertainties in the diagnosis can lead to increased costs.

Regional differences in testing are also worth considering in this context. Previous reports suggest that patients from the northeastern US have considerably higher costs compared with patients from the west, south, and midwest regions of the country.[30] A study conducted by Adams et al[31] showed that vestibular test claims originated from a broad range of specialists aside from otolaryngology, with primary care physicians submitting 30.2% of the claims. In that same study, a heat map of the utilization intensity showed that most of the vestibular testing occurred along the southern and eastern coasts. The reasons for such high utilization of tests in these regions remain unclear. One hypothetical reason for this could be the diminished number of vestibular clinicians and experts in certain regions compared with others. As a result, inexperienced health care professionals might be more likely to order tests than not. Interestingly, when we compare this study's cost expenditure index of BPPV, MD, and VM to the study by Adams et al, there is a lot of overlap in regions. It is possible that the regions associated with the highest medical expenditures for MD, VM, and BPPV might be related to the higher vestibular test claims

Figure. Heat Map of the Total Cost of Benign Paroxysmal Positional Vertigo, Ménière Disease, and Vestibular Migraine



Flags represent the locations of dizziness and balance centers associated with large academic institutions.

in those regions. This may hold true for other vestibular disorders as well and not just MD, VM, and BPPV. However, direct comparisons cannot be made because the study by Adams et al was based on Medicare claims and this study was based on a younger population of non-Medicare claims. Therefore, future studies should be directed toward exploring this relationship and understanding the regional discrepancy in the cost of vestibular diagnoses.

Another possible explanation of inflated costs in this data set for those areas could be the Stroke Belt.[32] The Stroke Belt, also known as Stroke Alley, is a region in the southeastern US that has been recognized by public health officials for having an unusually high incidence of strokes and other forms of cardiovascular disease. It is usually defined as an 11-state region including Alabama, Arkansas, Georgia, Indiana, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia. It is often disputed if Texas belongs in the Stroke Belt. Owing to the unusually high incidence of strokes in this area, including in younger patients, clinicians are more likely to perform neuroimaging to rule out that diagnosis, which may explain the elevated cost for vestibular disorders in this region. Kattah et al[33] demonstrated in 2009 that a well-conducted clinical examination can be more sensitive than an MRI in detecting an early stroke in the setting of an acute vertigo syndrome. Furthermore, a 2013 study by Newman-Toker et al[34] showed 100% accuracy in using bedside oculomotor tests to distinguish strokes from acute vertigo syndromes in the emergency department. However, there is often an overlap across many different specialties for those types of patients, and the educational curriculum for addressing vestibular disorders varies. This overlap and heterogeneity of training could be contributing to the costs of episodic recurrent vestibular vertigo. Recently, the Bárány Society suggested a standardized curriculum directed toward various different clinicians who interface with those patients.[35] This could be a step in the right direction to improve recognition and management of those disorders.

While this study controls costs associated with socioeconomics, demographics, and comorbidities, the estimate for the total economic burden does not account for indirect costs, such as lost productivity, occupational absenteeism and disability, stress and anxiety, or death.[10,14] Agrawal et al[11] estimated that the decrease in quality of life in patients with vertigo was equivalent to a cost of $64 929 per patient over a lifetime. Another study describes that up to 12% of patients with dizziness may end up on work disability.[14] Other factors include the length of time it takes to adequately diagnose and manage patients with vertigo, which can be because of a multitude of different causes. Indirect costs also tend to be higher than direct costs.[15] One study by Bjorne et al[36] showed that the costs to society of patients with untreated MD end up being 5 times higher than the cost of treating MD. Although more difficult to assess, stress and anxiety are other indirect costs that can have profound effects on a patient's quality of life. Several studies have linked the association between vertigo disorders, such as persistent postural-perceptual dizziness, and anxiety together.[23,37] Thus, the chronic nature of these vestibular disorders, in addition to late diagnosis, can further increase anxiety levels.

Comparison of Costs With Other Chronic Diseases

In 2020, the estimated prevalence of diabetes in the US was 34.2 million people, or 10.5% of the US population (eTable in the Supplement).[1] The national cost of diabetes in 2017 was

$327 billion, of which $237 billion (73%) represented direct costs and $90 billion (27%) represented indirect costs.[38] For comparison, the prevalence of arthritis is estimated to be about 58.5 million people, or 23.7% of US adults.[39] The estimated total national arthritis-attributable medical expenditures was $139.8 billion and attributable earning losses or indirect costs was $163.7 billion.[40] The prevalence of migraines in 2020 was estimated to be about 52.4 million people, or 15.9% of US adults.[41] The total direct and indirect costs associated with a diagnosis of migraine headaches amounted to an estimated $36 billion.[42] The total direct cost equated to an estimated $28.2 billion per year. The prevalence of asthma in 2013 was approximately 22.6 million people, or 7.3% of the US population. The total annual cost, including direct and indirect costs, was $81.9 billion.[43] Direct costs constituted 61% of the total annual cost (approximately $50 billion). Even though vestibular vertigo affects a smaller percentage of the US population compared with diabetes, arthritis, migraine, and asthma, the total cost for these combined vestibular disorders is second only to diabetes. While diabetes, arthritis, asthma, and even migraine headaches have rather stereotypical presentations and objective diagnostic markers, episodic recurrent vertigo does not, which makes it difficult to diagnose. Major vertigo attacks often lead to emergency department visits, and the workup completed in the emergency department ends up being about ruling out posterior fossa stroke rather than diagnosing the disorder. Patients may also have another comorbid vestibular disease that can further complicate a patient's clinical picture and lead to unnecessary interventions.[4] Patients might seek second opinions, which can lead to another set of workups. There are also unnecessary physical therapy sessions, mistaken diagnosis of BPPV, and psychiatric comorbidities associated with these disorders.[44,45] As a result, it is not uncommon to see patients visit multiple clinicians repeatedly for a while before a definitive diagnosis can be finally made.[46] It is possible that the costs associated with these visits, tests, and imaging all eventually contribute to the inflated costs associated with episodic vertigo. By highlighting the considerable economic burden associated with the most frequent causes of recurrent episodic vertigo, this study identifies those disorders as potential targets of interventions to reduce the overall cost burden of vertigo.

Limitations

The present method of capturing patients with VM most likely included patients who did not fully meet the Bárány Society criteria[47] for VM. This presents as a potential limitation of the study; however, it is also likely that the present VM group is still an underestimation of the actual number of patients with VM. Another limitation to the study was the quantification of the inpatient scan results. Unless the patient had a condition that would result in extra compensation for scans, imaging in the inpatient setting is usually not well documented on discharge summaries and hence not reflected in the MarketScan database. This indicates that the numbers we are reporting could still be an underestimation of the actual number of scans.

Conclusions

This economic evaluation demonstrates that the 3 most common causes of episodic recurrent vertigo—MD, VM, and BPPV—account for considerable increases in medical expenditure costs. Extraneous imaging orders and vestibular testing are factors to consider for cost reduction. However, further research is needed to optimize the diagnosis, treatment, and care of patients presenting with vestibular disorders or dizziness.

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Drafting of the manuscript: Jeong, Johnson, Rizk.
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