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Predictive Capability of Historical Data for Diagnosis of Dizziness

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Introduction

Dizziness is the third most common patient complaint in general medical clinics in the US,¹ and accounts for 8 million presenting complaints a year.² It also accounts for 4% of emergency department visits.³ Dizziness and postural instability increase in prevalence with increasing age, and affect over 50% of the elderly.² It is the most common presenting complaint for patients over seventy-five.⁴ For the patient, dizziness is incapacitating and leads to decreased productivity, clinical depression,⁵ and falls and injuries.⁶

Although dizziness is common and debilitating, clinical diagnosis is often difficult due to the broad differential diagnosis encompassing vestibular, neurological and cardiological factors.⁷ The physician must rely on a thorough history and physical examination to determine the next steps for evaluation.⁸ Once the correct diagnosis is made, effective treatments are often available depending on etiology.^{9,10,11} However, the burden of diagnosis frequently falls on primary care and emergency medicine doctors, who face significant time and resource pressures, and often find dizziness one of the more challenging aspects of practice. Patient verbal descriptions of the quality of dizziness tend to be unclear, inconsistent, and unreliable,¹² and physician dependence on symptom quality over other clinical features like timing and associated symptoms might predispose them to misdiagnosis.¹³ In the face of such diagnostic challenges, and in the era of efficiency and cost reduction, a simple, inexpensive, and accurate questionnaire-based diagnostic algorithm would be highly welcome.

Previous attempts for creating an algorithm for diagnosis of dizziness have been described. Kentala et al in 1996 were able to obtain 90% prediction accuracy in the six diagnostic categories of BPPV, Meniere's disease, vestibular schwannoma, vestibular neuritis, sudden deafness, and traumatic vertigo using a 13-item algorithm.¹⁴ However, they had included test results such as pure-tone thresholds, caloric excitability and spontaneous nystagmus

using electronystagmography, and quiet stance in posturography, in addition to history. Other similar studies using sophisticated algorithm networks or otoneurological expert systems as analysis tools also produced promising results, but similarly relied on specialized tests.^{15,16,17,18,19} These results could only come after a full examination and diagnosis by a balance specialist, and offer little to the primary care doctor presented with an initial complaint of dizziness. In 2003, Kentala & Rauch used a 3-parameter questionnaire to predict among the four categories of BPPV, Meniere's disease, vestibular neuritis, and labyrinthitis, and predicted 21 out of 35 diagnoses correctly (60% accuracy).²⁰ In order to create a screening tool that is widely adopted into standard practice, higher prediction accuracy would be desirable.

For the past two decades, our balance center has utilized a standardized approach to evaluate dizzy patients, believing that a systematic analysis of patient responses will isolate important factors better than clinical judgment alone. One component of this standardized approach utilizes a clinical questionnaire filled out before the physician visit. In this study, we used the current questionnaire to systematically isolate groupings of questions which are predictive of each clinical diagnosis, and determined the power of particular sets of symptoms to distinguish between different diagnoses of dizziness.

Methods

Study Design and Subjects

This study was a retrospective review of charts of adult patients seen by an experienced otologist between 09/2004 and 09/2007, in a specialized dizziness and balance center. A total of 619 patients were eligible and participated in the study. All patients had completed a questionnaire before their visit requesting information on their dizziness and review of system, and had an ultimate specific diagnosis of dizziness or postural instability listed in their chart at the end of evaluation. The study was reviewed and approved as expedited via the institutional review board (IRB# 07-1085).

Questionnaire

All subjects were administered a standard 163-item questionnaire which was filled out independently prior to the physician interview and took about an hour on average to complete. (see Figure, Supplemental Digital Content 1, Dizziness Questionnaire). In addition to demographic information (Table 1), questions asked fell into one of the following broad categories:

1. Description of the spell
2. Symptoms indicative of peripheral etiology
3. Symptoms indicative of central etiology
4. Auditory complaints
5. General physical and emotional health questions

The first four categories, consisting of 86 questions, made up the main questionnaire. Some questions were dichotomous ("Do you feel like you're spinning in circles?"), while others had multiple choice categories ("In which position are you most dizzy?"). When patients neglected to answer a clear dichotomous question ("Are you sensitive to light during a dizziness attack?") an answer of "No" was inferred. Such inferences were done in lieu of imputing data,^{21,22} and were felt justified because a patient was much less likely to leave a dichotomous question blank if it truly applied to his condition.

The last category of questions was a general review of systems, containing 77 questions regarding overall health complaints.

Statistical Analysis

Descriptive statistics were used to analyze the study population and distribution of diagnosis. Bivariate analysis using Chi Square test and odds ratios (OR) were used to investigate relationships between all 163 questionnaire items and the presence of each specific diagnoses of interest. Multinomial logistic regression analysis was used for multivariate modeling after screening of variables by binary logistic regression.

For each of the diagnostic categories, statistically significant questions on bivariate analysis ($p < 0.05$) or statistically non-significant questions with ORs greater than 2.0 or less than 0.5 were chosen and entered into binary logistical regression analysis. The ORs 2.0 and 0.5 were chosen a priori, with the purpose of including in the logistic regression those variables with large ORs which may not be shown with 95% certainty to be significantly associated with a certain diagnosis. Binary logistic regression analysis was performed for 2 main reasons: first to identify groups of questions significantly predicting each diagnosis, and second to minimize the number of variables entered into multinomial logistic regression later. A set of statistically significant ($p < 0.05$) predictors from logistic regression were compiled for each diagnostic category.

Significant variables identified from binary regressions were then entered into multinomial logistic regression both to test the predictive power of the regression model, and to attempt to further narrow the field of questions. Predicted diagnostic categories from the multinomial logistic regression model were then compared to the ultimate clinical diagnosis to determine the predictive power of the statistically significant questions.

The statistical analysis was performed using the SPSS 17.0.2 software package (SPSS Inc., Chicago, IL). Two tailed tests of significance were used, and significance was established at the $p < 0.05$ level.

Results

Descriptive Characteristics

The descriptive of characteristics of all subjects are presented in Table 1. The mean age at initial diagnosis was 57 years (S.D. 16 years, range 19 – 89 years). The frequency distribution of gender among those reporting was 235 (40%) males and 357 (60%) females. There were 463 (89%) Caucasians, 39 (8%) African-Americans and 17 (3%) patients of other races.

Twenty-three different ultimate diagnoses were assigned to this group of patients after final evaluation by the senior author (JAG). The most common four diagnoses were BPPV (164 subjects, 26.5%), migraine dizziness (101 subjects, 16.3%), Meniere's disease (82 subjects, 13.2%), and vestibular neuritis (49 subjects, 7.9%). Together, these four diagnoses made up 64.0% of total patients. Due to insufficient subjects for the 19 less commonly identified diagnoses, we consolidated these diagnoses into three groups for the purpose of logistic regression: 1) "Other Vestibular", 2) "Other CNS", and 3) "Other Miscellaneous". (Table 1) Both binary and multinomial logistic regressions used these 7 diagnostic categories as dependent variables.

Bivariate Odds Ratio Analysis

Bivariate analysis identified questions and complaints that were positively or negatively correlated with each of the diagnosis as reported below:

BPPV was positively correlated with a history of dizziness when lying down (OR = 9.7; 95% CI = 6.1 – 15.6), position-dependent dizziness (OR = 3.6; 95% CI = 2.4 – 5.5), and attacks on the order of seconds (OR = 2.8, 95% CI = 1.7 – 4.6), and was negatively correlated with hearing changes (OR = 0.2, 95% CI = 0.1 – 0.4), light sensitivity (OR = 0.2, 95% CI = 0.1 – 0.5), and length of attack of several hours to a day (OR = 0.3, 95% CI = 0.1 – 0.8).

Migraine dizziness was most positively correlated with light sensitivity (OR = 41.8, 95% CI = 23.4 – 74.8), menstrual cycles (OR = 6.9, 95% CI = 3.2 – 15.0), and severe or recurrent headaches (OR = 5.5, 95% CI = 3.4 – 8.9), and was most negatively correlated with tinnitus (OR = 0.4, 95% CI = 0.2 – 0.8), positional dizziness (OR = 0.4, 95% CI = 0.2 – 0.9), and systemic symptoms like nocturnal urination (OR = 0.5, 95% CI = 0.2 – 0.9).

Meniere's disease was most positively correlated with auditory symptoms during attack such as hearing change (OR = 7.5, 95% CI = 4.5 – 12.5), unilateral worsening of hearing (OR = 7.4, 95% CI = 3.9 – 14.0), and unilateral tinnitus (OR = 6.2, 95% CI = 3.1 – 12.7), and was most negatively correlated with positional dizziness (OR = 0.2, 95% CI = 0.02 – 1.2), recent head trauma (OR = 0.2, 95% CI = 0.1 – 0.5), and mucus (OR = 0.3, 95% CI = 0.1 – 0.9).

Vestibular neuritis was positively correlated with nausea (OR = 1.98, 95% CI = 1.1 – 3.7), and was most negatively correlated with light sensitivity (OR = 0.2, 95% CI = 0.1 – 0.9), indigestion (OR = 0.2, 95% CI = 0.1 – 1.0), and ear pain (OR = 0.3, 95% CI = 0.1 – 0.7).

Multivariate Binary Logistic Regression Analysis

Table 2 summarizes the results of multivariate binary logistic regression for each of the seven main diagnosis groups.

The odds for a diagnosis of BPPV were 15.5 times higher (95% CI: 7.3 – 33.1) for patients with dizziness while lying down; 8.4 times higher (3.5 – 19.9) for patients with dizziness with head movement; 4.1 times higher (1.2 – 13.7) for patients with dizziness when bending over and 2.0 times higher if patients were free from dizziness between attacks (1.0 – 3.8). Each additional year in age increases the odds of diagnosis of 1.046 times (1.027 – 1.066). Male patients (OR=0.4) had lower odds for BPPV, as did those with ear pain or discharge (OR=0.2); hearing worsening (OR=0.2); unilateral ringing in ears (OR=0.4); or longer dizzy episodes with durations 20 min – hours (OR = 0.1), hours – 1 day (OR = 0.1); or 1 day – 1 week (OR = 0.3).

As expected, light sensitivity was a very strong predictor of migraine associated dizziness with odds for disease 41.1 times higher in patients reporting the symptom (95% CI: 15.8 – 108.2). The odds of migraine associated dizziness were 8.5 times higher for patients whose dizziness was menstrual cycle associated (2.1 – 34.4); 3.1 times higher for patients with stuffy nose at time of attack (1.2 – 7.9); and 5 - 9 times higher in patients with dizzy episodes at least once per month or more. Hearing changes when dizzy (OR=0.1), dizziness when lying down (OR=0.2), frequent night urination (OR=0.3), male gender (OR=0.3) and increasing age (OR=0.948 per year older) all lowered the odds for migraine associated dizziness.

Significant predictors that increased the odds of diagnosis of Meniere's disease were: hearing changes (OR = 6.2, 3.1 – 12.6); sensation of world spinning around one (OR = 4.3,

2.1 – 9.0); male gender (OR = 4.1, 2.1 – 8.0); and unilateral tinnitus (OR = 3.8, 2.0 – 7.4). The odds of Meniere's disease were lower if the patient reported recent head trauma (OR = 0.1); mucus (OR = 0.1); and positional dizziness, especially dizziness while lying down (OR = 0.1), with head movement (OR = 0.2); or while sitting or standing (OR = 0.3).

Vestibular neuritis was positively predicted by nausea and nasal obstruction, and negatively predicted by shortness of breath. Indigestion, freedom from dizziness between attacks, and falling to one side were all symptoms that decreased the odds of a diagnosis in the "Other Vestibular" group. Odds for a diagnosis in the "Other CNS" category were increased by a swimming sensation, confusion or memory loss, severe headaches, and constant dizziness; odds were decreased by a sensation of the world spinning around one, light sensitivity, hearing change when dizzy, and increasing age. Diagnoses in the "Other Miscellaneous" category were indicated by decreased appetite, loss of consciousness, black outs when dizzy, slurred speech, fatigue, increased age, and systemic symptoms like indigestion, joint pain. "Other Miscellaneous" diagnoses were predicted against by a sensation of the world spinning around one, overexertion related dizziness, ear fullness, tingling around the mouth, and dizziness while lying down.

In sum, binary logistic regressions examined all variables which showed significant or large correlations with any specific diagnosis on bivariate analysis, and narrowed them down to 47 significant variables in total for the seven diagnostic categories.

Multivariate Multinomial Logistic Regression Analysis

Multinomial logistic regression of the same 47 variables yielded a model with high predictive power (> 80% sensitivity) for BPPV, migraine, Meniere's disease, and "Other Miscellaneous", good predictive power (> 70% sensitivity) for "Other Vestibular", and fair predictive power (> 60% sensitivity) for vestibular neuritis and "Other CNS". The greatest sources of error in the model were the confusion of BPPV with either vestibular neuritis, or with "Other CNS". The regression model had a high Cox & Snell R^2 (0.928). Out of 393 patients who had valid responses to all 47 questions, the model was able to match the patient with the right ultimate clinical diagnosis 329 times, for an overall prediction sensitivity of 83.7%.

Multinomial logistic regression through a backward elimination method eliminated 15 further variables. The simplified 32 variable model had a Cox & Snell R^2 of 0.880, and had high predictive power (> 80% sensitivity) for Meniere's disease, good predictive power (> 70% sensitivity) for BPPV and migraine, fair predictive power (> 60% sensitivity) for "Other Vestibular" and "Other Miscellaneous", and poor predictive power (< 60% sensitivity) for "Other CNS" and vestibular neuritis. Out of 413 patients with valid responses to all 32 questions, 295 patients were correctly matched with the right ultimate clinical diagnosis, with an overall sensitivity of 71.4%.

Although the 32 item model was simpler and would help build a shorter questionnaire for the patients, its simplicity was gained at the cost of poorer predictive power. This model showed the greatest decrease in sensitivity in vestibular neuritis. The 47 item model with better predictive power and sensitivity appears more suitable to build a new questionnaire-based screening tool. The new questionnaire will be shorter than the existing one, and less time consuming for patients to complete and for the physicians to abstract the information needed for providing an accurate diagnosis.

Discussion

Results from this study demonstrate the power of historical data to predict the ultimate diagnosis for patients with dizziness. From a standard questionnaire, a subset of 47 variables was isolated such that the resulting predictive model correctly matched a patient to his ultimate clinical diagnosis 84% of the time. This level of predictive accuracy from a purely historical screening tool had only been previously achieved among pediatric patients.²³ Among the adult population, predictive power was higher than that previously achieved by historical analysis,²⁰ and almost on par with predictive algorithms which included clinical vestibular function tests.^{14,16,17} These findings strongly suggest that a historical screening tool, drawing upon the experiences of this study, can play a vital role in the initial assessment of dizzy patients.

The predictive model performed best on BPPV, migraine associated dizziness, and Meniere's disease. The reason for such good predictive values may lie in the fact that each of these three diagnoses had several factors that were both sensitive and specific. These included positional dizziness and short duration for BPPV, light sensitivity and menstrual-association for migraine, and auditory changes and tinnitus for Meniere's disease. The clear association shown in the study between these clinically relevant factors and the diagnoses corroborated well with current medical knowledge.^{6,7,8,24,25,26}

On the other hand, predictive power was less than expected for vestibular neuritis. Differences in predictive power between various diagnoses may be explained by three factors. First, some patients had two types of dizziness, especially co-morbid BPPV and vestibular neuritis. This may have contributed to the model's low sensitivity for vestibular neuritis. Second, some diagnoses had considerably more significantly-correlated variables than other diagnoses. For example, bivariate analysis identified 52 variables which were significantly correlated to BPPV and only 8 variables for vestibular neuritis (only one of which was positively correlated). Similarly, diagnoses with good predictive power tended to have more significant predictors from binary logistic regression analysis as well (Table 2). And third, the specificity of variables to a diagnosis also played a major part in eventual predictive power. For example, from bivariate analysis, the odds ratio of the association between migraine associated dizziness and light sensitivity was 42, much stronger than any other correlation. This highly specific symptom helps explain why the multinomial regression models had such high predictive power for migraine, and why a prediction of migraine showed such high specificity. On the other end of the spectrum, the only variable positively correlated to vestibular neuritis was nausea, which had an odds ratio of only 1.98.

Having so few significantly correlated variables may help explain the big difference from multinomial logistic regression, between the predictive powers of the 47 variable model and the 32 variable simplified model, especially for vestibular neuritis and "Other CNS". Predictive power for these two diagnoses may depend on a large number of less sensitive variables, which when eliminated to create the simplified model, has an effect on these diagnoses disproportionate to other diagnoses.

Overall, decreasing the number of variables in multinomial logistic regression to 32 significantly decreased the predictive power of the model. While BPPV, migraine, and Meniere's disease were still adequately predicted by the simplified model, this approach had decreased predictive power for the less common diagnoses (Table 3). Therefore, the 47 variable model, created from the results of binary logistic regressions, appears more suitable to form the basis of any efforts to construct a new questionnaire-based screening tool.

While retrospective analysis of the current questionnaire yielded a predictive model with high overall sorting accuracy, a new streamlined questionnaire to be examined in a

prospective study would be useful to further validate the utility of using historical data to screen dizzy patients. It would be shorter and take less than ten minutes to complete and would offer the opportunity to incorporate reworded questions that target areas of poorer sensitivity in the current questionnaire, while eliminating redundant, open-ended or double-barrelled questions to reduce confusion and increase questionnaire validity (i.e. length of vertigo episodes). The construction of a new questionnaire may also address the inherent weakness of missing data in the current clinical study. Making sure patients answer every item on the questionnaire would obviate the need for inferring or imputing data, which while useful for situations of missing data remains less than optimal.^{21,22} The construction of a more parsimonious and streamlined questionnaire that retains high question sensitivity and predictive power, will be one significant advantage of a prospective examination of the screening tool.

Despite the inherent limitations, results from the current study were promising and highly encouraging. The fact that a 47 question subgroup from a questionnaire not specifically created to undergo logistic regression analysis could predict the ultimate clinical diagnostic category with such high accuracy is a testament to the utility of a structured questionnaire as an initial evaluation tool for dizziness. Ultimately, the construction of a web-based program for computerized analysis and generation of an odds ratio based differential diagnosis has the potential to become part of standard initial evaluation of all dizziness patients at the primary level to help determine appropriate referral. The next phase of this project is currently underway and the final form and number of questions is being developed.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Characteristics of the Study Population

Characteristics	N (%)
Age	
Mean ($\pm$ St. Dev.)	57 ($\pm$ 16)
Gender	
Male	235 (40)
Female	357 (60)
Race	
Caucasian	463 (89)
African-American	39 (8)
Other	17 (3)
Diagnosis Categories	
BPPV	164 (26.5)
Migraine Assoc. Dizziness	101 (16.3)
Meniere's Disease	82 (13.2)
Vestibular Neuritis	49 (7.9)
Other Vestibular	56 (9.0)
Bilateral vestibular loss	22 (3.6)
Unilateral vestibular loss	18 (2.8)
Superior canal dehiscence	8 (1.3)
Vestibular schwannoma	5 (0.8)
Fistula / hydrops	3 (0.5)
Other CNS	76 (12.3)
Anxiety-related	22 (3.6)
Central	16 (2.6)
Motion sickness	7 (1.1)
Arachnoid cyst	7 (1.1)
Traumatic / posttraumatic	6 (1.0)
Oculomotor cerebellar dysfunct	5 (0.8)
Parkinsonism	4 (0.6)
Normal pressure hydrocephalus	4 (0.6)
Visual	3 (0.5)
Central Lyme w/ possible labyrinthine	2 (0.3)
Other Miscellaneous	78 (12.6)
Cardiogenic / Orthostasis	29 (4.7)
Cerebrovascular	19 (3.1)
Postural instability	18 (2.9)
TMJ / cervical disequilibrium	12 (1.9)

Table 2

Significant variables for each diagnostic category from binary logistic regression

Diagnostic Category	Variable	Odds Ratio	95% CI for OR		p value
			Lower	Higher	
BPV					
Positive predictors					
	Dizziness greatest in position: lying down	15.5	7.3	33.1	<0.001
	Dizziness greatest in position: head movement	8.4	3.5	19.9	<0.001
	Dizziness greatest in position: bending over	4.1	1.2	13.7	0.022
	Free from dizziness b/w spells	2.0	1.0	3.8	0.037
	Age when seen for first appointment*	1.046	1.027	1.066	<0.001
Negative predictors					
	Pain or discharge of ear	0.2	0.1	0.6	0.002
	Unilateral hearing change for worse	0.2	0.1	0.6	0.006
	Unilateral ringing in ears	0.4	0.2	0.8	0.008
	Male gender	0.4	0.2	0.7	0.002
	Length 20 min – hours	0.1	0.0	0.4	<0.001
	Length hours - 1 day	0.1	0.0	0.5	0.007
	Length 1 day - 1 week	0.3	0.1	0.7	0.008
Migraine Associated Dizziness					
Positive predictors					
	Light sensitive	41.4	15.8	108.2	<0.001
	Dizziness menstrual related	8.5	2.1	34.4	0.003
	Stuffy nose	3.1	1.2	7.9	0.015
	Frequency daily or more	5.5	1.8	16.9	0.003
	Frequency weekly - daily	9.3	2.4	36.4	0.001
	Frequency monthly - weekly	5.0	1.2	21.0	0.029
Negative predictors					
	Change in hearing when dizzy	0.1	0.0	0.4	0.001

Diagnostic Category	Variable	Odds Ratio	95% CI for OR		p value
			Lower	Higher	
	Lying down	0.2	0.0	0.8	0.027
	Male gender	0.3	0.1	0.8	0.020
	Frequent night urination	0.3	0.1	1.0	0.048
	Age when seen for first appointment*	0.948	0.919	0.977	0.001
Meniere's Disease					
Positive predictors					
	Hearing change during attack	6.2	3.1	12.6	<0.001
	World spinning around	4.3	2.1	9.0	<0.001
	Male gender	4.1	2.1	8.0	<0.001
	Unilateral ringing in ears	3.8	2.0	7.4	<0.001
Negative predictors					
	Recent head trauma	0.1	0.0	0.5	0.003
	Mucus	0.1	0.0	0.6	0.008
	Lying down	0.1	0.0	0.3	<0.001
	Head movement	0.2	0.1	0.9	0.039
	Sitting or standing	0.3	0.1	0.7	0.008
Vestibular Neuritis					
Positive predictors					
	Nasal obstruction	3.3	1.2	9.7	0.027
	Nausea	2.3	1.2	4.4	0.010
Negative predictors					
	Shortness of breath	0.3	0.1	0.9	0.038
Other Vestibular					
Negative predictors					
	Indigestion	0.1	0.0	0.8	0.031
	Free from dizziness b/w spells	0.4	0.2	0.7	0.003
	Fall to one side	0.5	0.3	0.9	0.020
Other CNS					

Diagnostic Category	Variable	Odds Ratio	95% CI for OR		p value
			Lower	Higher	
Positive predictors					
	Swimming sensation	2.4	1.2	4.7	0.011
	Confusion / memory loss	2.3	1.3	4.1	0.005
	Severe Headache	2.1	1.2	3.7	0.015
	Constant dizziness / unsteadiness	2.1	1.2	3.6	0.010
Negative predictors					
	Light sensitive	0.2	0.1	0.5	0.001
	Hearing change when dizzy	0.2	0.1	0.6	0.005
	World spinning around	0.5	0.3	0.8	0.004
	Age when seen for first appointment*	0.967	0.950	0.985	<0.001
Other Miscellaneous					
Positive predictors					
	Decreased appetite	4.0	1.5	10.7	0.006
	Loss of consciousness	3.3	1.5	7.5	0.004
	Black outs or faint when dizzy	3.1	1.1	8.7	0.029
	Slurred speech	2.8	1.2	6.3	0.015
	Indigestion	2.6	1.3	5.5	0.010
	Joint pain / stiffness	2.5	1.3	4.5	0.004
	Fatigue	1.9	1.0	3.6	0.038
	Age when seen for first appointment*	1.033	1.013	1.054	0.001
Negative predictors					
	Tingling around mouth	0.2	0.0	0.7	0.016
	Dizziness overexertion related	0.2	0.1	0.7	0.010
	World spinning around	0.3	0.2	0.6	0.001
	Unilateral fullness in ears	0.4	0.2	0.8	0.011
	Dizzy lying down	0.4	0.2	0.8	0.014

* continuous variable

Predicted diagnosis by multinomial LR (direct entry method) vs ultimate clinical diagnosis (47 variables, 393 subjects, Cox & Snell R²: 0.928)

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Table 3b

Predicted diagnosis by multinomial LR (direct entry method) vs ultimate clinical diagnosis (simplified model of 32 variables)

Observed	Predicted						
	BPPV	Migraine	Meniere's	Vestibular Neuritis	Other Vestibular	Other CNS	Other Other
BPPV	98	5	3	3	2	6	6
Migraine	6	52	0	2	3	3	1
Meniere's	3	1	49	4	2	0	0
Vestibular Neuritis	10	1	4	13	1	0	3
Other Vestibular	3	1	3	1	23	4	1
Other Central	6	4	1	0	3	24	5
Other	9	1	2	0	1	4	36
Overall Percentage	32.7%	15.7%	15.0%	5.6%	8.5%	9.9%	12.6%
							71.4%