Burden of Dizziness and Vertigo in the Community

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Background: Dizziness and vertigo are common, however, the cause often remains unexplained. The percentage of vertigo of vestibular origin in individuals with unselected dizziness has not been well examined, and its underestimation may lead to diagnostic bias in primary care. The purpose of this study was to reassess the burden of dizziness in the community and to quantify the contribution of vertigo of vestibular origin.

Methods: A nationally representative sample of 4869 adults living in Germany was screened for moderate or severe dizziness, and 1003 individuals with dizziness underwent validated neurotologic interviews to differentiate vestibular vertigo from nonvestibular dizziness according to explicit diagnostic criteria.

Results: Dizziness/vertigo had a prevalence of 22.9% in the last 12 months and an incidence (first episode of dizziness/vertigo) of 3.1%. For vestibular vertigo, the prevalence was 4.8% and the incidence was 1.4%. A medical consultation because of incident dizziness/vertigo was reported by 1.8% of unselected adults who consulted a physician in the last 12 months for incident dizziness/vertigo (0.9% for vestibular vertigo). Compared with nonvestibular dizziness, vestibular vertigo was more frequently followed by medical consultation (70% vs 54%; $P<.001$), sick leave (41% vs 15%; $P<.001$), interruption of daily activities (40% vs 12%; $P<.001$), and avoidance of leaving the house (19% vs 10%; $P=.001$). However, more than half of the participants with vestibular vertigo reported nonvestibular diagnoses. Age- and sex-adjusted health-related quality of life was lower in individuals with dizziness and vertigo compared with dizziness-free control subjects.

Conclusions: The occurrence of dizziness and vertigo is frequent and associated with a considerable personal and health care burden. Vestibular vertigo accounts for a considerable percentage of this burden, which suggests that diagnosis and treatment of frequent vestibular conditions are important issues in primary care.

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RESEARCH ON THE PERSONAL and health care burden of ill health usually focuses on specific diseases rather than symptoms.[1] This diagnosis-based approach, however, may underestimate the burden of common symptoms such as dizziness and vertigo, which rank among the most frequent complaints in primary care but remain unexplained in 40% to 80% of cases.[2-5] In addition, although dizziness and vertigo may be caused by a variety of conditions, often requiring a multidisciplinary approach, they rarely prompt referral to a specialist or a hospital admission for specific investigation.[5,6] For example, frequent conditions such as benign paroxysmal positional vertigo,[7] migrainous vertigo,[8] and psychiatric dizziness[9] remain largely underdiagnosed outside of specialty clinics. Moreover, epidemiologic data on the prevalence of specific dizziness and vertigo disorders are scarce and based primarily on selected case series or not explicitly defined diagnostic criteria.[10-12] Because of these restrictions, little is known about the personal and health care burden of dizziness and vertigo in the community, in particular, about the specific effect of vestibular vertigo and its underlying disorders. Valid estimates of the frequency and burden of distinctive types of dizziness and vertigo, however, may guide diagnostic decision making[13] and, thus, enable improved patient care. The purpose of this study was to investigate the personal and health care burden of dizziness and the relative contribution of vestibular vertigo with validated neurotologic interviews in a large, nationally representative, general population sample in Germany.

METHODS

STUDY DESIGN AND POPULATION

We conducted a cross-sectional study on the epidemiology of the symptoms dizziness and vertigo in the general adult population living in Germany in 2003. Details of the study de-

sign have been published previously.[14] In brief, the purpose of the study was to differentiate vertigo as a vestibular symptom from nonvestibular dizziness in a large sample representative of the general adult population in Germany. Therefore, we combined a population-based general health survey sampling design for detection of reported dizziness and vertigo and a subsequent neurotologic interview approach for subclassification of dizziness and vertigo types and underlying disorders. A random sample of the general population aged 18 years or older was contacted by telephone from the German National Health Interview Survey 2003 (GNT-HIS); (n=8318; modified random digit sampling; response rate, 52%) and screened for the occurrence of dizziness with the question, "Did you ever experience moderate or severe dizziness or vertigo?" The state commissioner for data protection approved the study, and informed consent for further interviews was obtained from each participant. Subsequently, of a simple random sample of 4869 GNT-HIS participants, 1157 fulfilled the inclusion criteria for the neurotologic survey (history of moderate or severe dizziness or vertigo; consent for a further interview; and still valid telephone number),[14] and 1003 completed the neurotologic interview (response rate, 87%).

MEASUREMENTS

The neurotologic interview was developed by us through piloting and validation in a specialized dizziness clinic. It contained both open-ended and standardized questions and allowed for interactive questioning similar to a clinical situation. The interview was designed to differentiate vestibular vertigo from nonvestibular dizziness on the basis of explicit diagnostic criteria and to identify specific disorders (Meniere disease, migrainous vertigo, orthostatic dizziness, and benign paroxysmal positional vertigo).

Criteria for choosing specific dizziness diagnoses to be investigated in this study were adaptability of diagnostic criteria to an interview situation, availability of data from previous community-based studies, and length of the interview. Because of the overall interview length, we did not attempt to differentiate which participants with vestibular vertigo had additional nonvestibular dizziness but instead classified them only as having vestibular vertigo. We, therefore, report the prevalence and incidence for dizziness and vertigo together and for vestibular vertigo alone but not for nonvestibular dizziness, which is likely to be underestimated in our study.

The interviews were conducted by 2 medical students (F.L. and M.F.) who were extensively trained in a neurologic dizziness clinic for 1 year. They discussed each interview with 1 of 4 experienced neurotologists (H.N., A.R., M.v.B., and T.L.), who also personally supervised 10% of all interviews. Inconclusive diagnoses were discussed in case conferences with all 4 neurotologists involved in the study. If necessary, additional information was obtained in a complementary interview.

A diagnosis of vestibular vertigo required 1 of the following criteria: rotational vertigo, positional vertigo, or recurrent dizziness with nausea and either imbalance or oscillopsia. Rotational vertigo was defined as an illusion of self-motion or object motion, and positional vertigo was defined as vertigo or dizziness precipitated by changes in head position such as lying down or turning in bed. The diagnostic criteria for Meniere disease,[15] migrainous vertigo,[7] orthostatic dizziness,[16] and benign paroxysmal positional vertigo[9] have been reported previously. Vestibular vertigo was detected using our interview with a specificity of 94% and a sensitivity of 84% in a concurrent prospective validation study using neurotology clinic diagnoses as an accepted standard (n=61).[14] Thereby, the neurotologic survey interviewers conducted telephone interviews with consecutive new patients from 2 dizziness clinics before their first visit to the clinic. The telephone diagnoses were compared with diagnoses made by neurotologists who interviewed and examined the patients in the clinic and were blinded to the telephone interview results. The telephone diagnoses were made according to the diagnostic criteria used in the neurotologic survey, whereas clinic diagnoses were based on overall clinical evaluation using clinical history, neurotologic examination, and all available investigations including neurotologic tests.

In addition, the survey included questions on sick leave, hospitalization, avoidance behavior (fear of leaving the house because of dizziness or vertigo), use of health care services because of dizziness or vertigo, and health-related quality of life measured with the 8-item short-form health survey (SF-8). The SF-8 is a generic instrument for measuring health-related quality of life in the last 4 weeks constructed for use in population-based studies. It yields an 8-dimensional health profile and summary scores for the physical and mental components of health,[17] with scores ranging from 0 to 100; a higher score corresponds to higher health-related quality of life.

STATISTICAL ANALYSIS

The prevalence of vestibular vertigo was calculated taking into account the 2-stage sampling design by multiplying the percentage of vestibular vertigo in neurotologic survey participants with the percentage of dizziness and vertigo in GNT-HIS participants.[14] Thereby, nonresponders and those unavailable for follow-up between the 2 sampling stages were assumed to have the same probability of dizziness and vertigo as participants in the neurotologic survey. Confidence intervals for prevalence were calculated using a conservative method[18] and taking into account the loss of power through nonresponse and unavailability for follow-up between the GNT-HIS and the neurotologic survey. Results were considered significant at $P < .05$. Analyses were performed using commercially available software (SPSS for Windows version 14.0; SPSS Inc, Chicago, Illinois).

Factors associated with medical consultation were investigated in 3 separate logistic regression analyses using as dependent variables first dizziness/vertigo, then separately vestibular vertigo and nonvestibular dizziness. All prevalences refer to the group aged 18 to 79 years except for the age-specific prevalences and are standardized to the age and sex distribution in Germany in 2002 within 10-year age groups. Because of the relatively small numbers, standardization of the incidences and hospitalization rates was performed using only 3 age groups: 18 to 39, 40 to 59, and 60 to 79 years. Incidence was defined as the population percentage with a first attack of dizziness (not a new episode of a recurrent condition).

We compared age- and sex-adjusted SF-8 scores and 95% confidence intervals in all 8 subscales and in the 2 summary measures between 2816 population-sampled dizziness-free control subjects (all dizziness-free GNT-HIS participants), 66 participants with vestibular vertigo in the last 4 weeks, and 259 participants with nonvestibular dizziness in the last 4 weeks, using general linear model univariate procedures.

RESULTS

Of 1003 participants with dizziness/vertigo of at least moderate intensity, according to the study criteria, 243 had vestibular vertigo, 742 had nonvestibular dizziness, and in 18 participants, a differentiation between vestibular and nonvestibular dizziness could not be made. The life-

Table 1. Incidence and Prevalence of Moderate or Severe Dizziness and Vertigo in the General Adult Population

Variable	Population, % (95% CI)		
	Women	Men	Total
Incidence, 1 y			
Dizziness/vertigo	4.0 (3.2-5.0)	2.3 (1.6-3.1)	3.1 (2.6-3.8)
Vestibular vertigo	1.9 (1.4-2.7)	0.8 (0.4-1.3)	1.4 (1.0-1.8)
Severely impairing dizziness/vertigo[a]	2.6 (2.0-3.5)	1.4 (0.9-2.1)	2.0 (1.6-2.5)
Vestibular vertigo	1.5 (1.1-2.2)	0.6 (0.3-1.1)	1.1 (0.8-1.5)
Dizziness/vertigo leading to a medical consultation	2.2 (1.6-3.0)	1.4 (0.9-2.1)	1.8 (1.4-2.3)
Vestibular vertigo	1.2 (0.8-1.8)	0.6 (0.3-1.1)	0.9 (0.6-1.2)
Prevalence, 1 y			
Dizziness/vertigo	28.9 (26.8-31.1)	16.7 (15.0-18.6)	22.9 (21.5-24.3)
Vestibular vertigo	7.1 (6.0-8.4)	2.6 (1.9-3.5)	4.9 (4.2-5.7)
Prevalence, lifetime			
Dizziness/vertigo	35.9 (33.7-38.3)	22.6 (20.6-24.7)	29.3 (27.8-30.9)
Vestibular vertigo	10.3 (9.0-11.8)	4.3 (3.4-5.4)	7.4 (6.5-8.3)
Severely impairing dizziness/vertigo[a]	24.0 (22.0-26.1)	12.8 (11.3-14.5)	18.5 (17.2-19.8)
Vestibular vertigo	8.4 (7.2-9.7)	3.4 (2.6-4.4)	5.9 (5.2-6.7)
Dizziness/vertigo leading to a medical consultation	22.2 (20.3-24.4)	11.9 (10.5-13.6)	17.1 (15.9-18.4)
Vestibular vertigo	7.4 (6.3-8.7)	3.1 (2.3-4.1)	5.2 (4.5-6.1)
Dizziness/vertigo leading to a hospital visit	2.1 (1.5-2.9)	1.8 (1.2-2.5)	1.9 (1.5-2.4)
Vestibular vertigo	0.8 (0.5-1.3)	0.7 (0.4-1.3)	0.7 (0.5-1.1)

Abbreviation: CI, confidence interval.
[a] Severely impairing dizziness/vertigo leading to sick leave, medical consultation, or interruption of daily activities.

Table 2. Lifetime Medical Consultation Rates Because of Dizziness or Vertigo by Age and Specialty

Variable	Participants With Dizziness, %		
	Dizziness/ Vertigo (n = 1003)[a]	Vestibular Vertigo (n = 243)	Nonvestibular Dizziness (n = 742)
Medical consultation	58	70	54
Age, y			
18-39	48	60	46
40-59	62	70	58
≥60	72	78	67
Specialty			
General practice or internal medicine	52	57	49
Ear, nose, and throat	14	34	7
Neurology	16	30	12
Orthopedics	9	15	7
Radiology	8	15	5
Other	5	3	6
>1 Specialty	24	41	19
Hospitalization	7	10	5

[a] Includes 18 inconclusive cases in which a differentiation between vestibular and nonvestibular dizziness could not be made.

time prevalence of dizziness/vertigo of at least moderate intensity in community-dwelling adults aged 18 to 79 years in Germany was 29.3%, and the annual prevalence was 22.9%. Most of those reporting dizziness/vertigo in the last 12 months had recurrent attacks (96%), and only a few had persistent dizziness lasting longer than 1 month (1.4%) or a single attack of dizziness (2.6%). The annual incidence, that is, the annual rate of dizziness/vertigo occurring for the first time, was 3.1% (**Table 1**). Incident dizziness/vertigo was severely impairing in almost two-thirds of cases; it led to sick leave, medical consultation, or interruption of daily activities in the 12 months preceding the study in 2% of adults aged 18 to 79 years in Germany. All reported prevalences and incidences were higher in women than in men (Table 1).

We investigated the percentage of vestibular vertigo in individuals in the community with dizziness and in those seeking medical care. Vestibular vertigo accounted for 34% of incident cases of dizziness/vertigo and 21% of prevalent cases in the last 12 months. In 72 participants who consulted a physician because of new-onset (incident) dizziness/vertigo in the last 12 months, vestibular vertigo accounted for 36%. This percentage increased with age from 22% in participants aged 18 to 39 years to 31% in those aged 40 to 59 years and 52% in those aged 60 years or older. Vestibular vertigo also varied by medical specialty, reported in 35% of those consulting a general practitioner or internal medicine specialist; 50% of those consulting an ear, nose, and throat specialist; and 59% of those consulting a neurologist.

The annual medical consultation rate for new-onset (incident) dizziness/vertigo in unselected adults aged 18 to 79 years was 1.8%. Of these patients, 87% had recurrent dizziness, 3% had persistent dizziness lasting longer than 1 month, and 10% had a single attack of dizziness. At least 1 medical consultation because of dizziness/vertigo at some point in their life was reported by 17.1% of adults, that is, 58% of those with a history of dizziness/vertigo. Previous hospitalization because of dizziness/vertigo was reported by 1.9% of all adults or 7% of those with dizziness/vertigo. Both medical consultations and hospital visits were more frequent for vestibular vertigo than for nonvestibular dizziness (**Table 2**). Medical consultations were most frequent for benign paroxysmal positional vertigo (62 of 80 patients [78%]), followed by migrainous vertigo (22 of 33 patients [67%]), other ves-

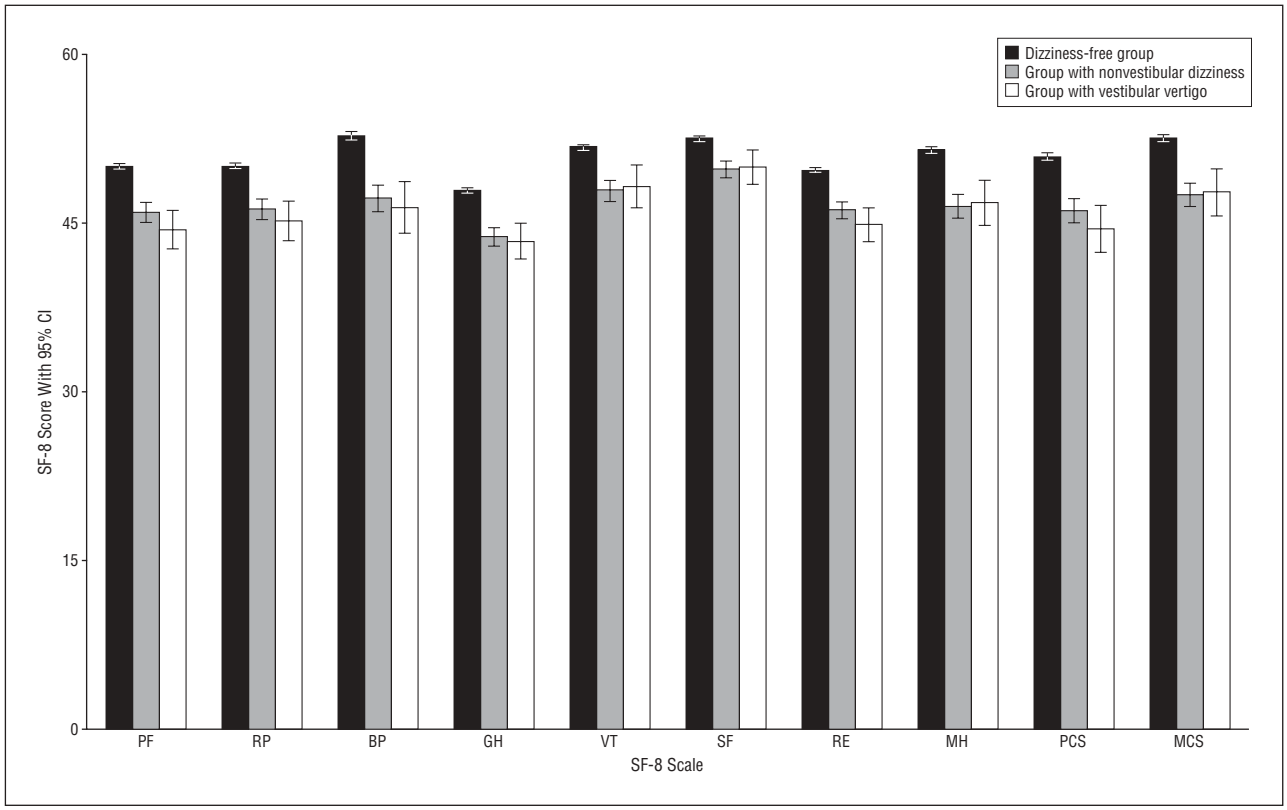

Figure. Age- and sex-adjusted health-related quality of life in 259 participants with nonvestibular dizziness in the last 4 weeks, 66 participants with vestibular vertigo in the last 4 weeks, and 2816 dizziness-free control subjects. SF-8 indicates 8-item Short-Form Health Survey; CI, confidence interval; PF, Physical Functioning; RP, Role-Physical; BP, Bodily Pain; GH, General Health; VT, Vitality; SF, Social Functioning; RE, Role-Emotional; MH, Mental Health; PCS, Physical Component Summary; and MCS, Mental Component Summary. The whiskers measure the 95% CI.

tibular vertigo (86 of 129 patients [67%]), other nonvestibular dizziness (242 of 396 patients [61%], and orthostatic dizziness (159 of 346 patients [46%]). Only about half of the patients were seen by primary care physicians, and the other half consulted various specialists, most frequently neurologists or ear, nose, and throat specialists. Only 70% of the 171 participants who had consulted a physician because of vestibular vertigo stated that an explicit diagnosis was made, and less than half of the diagnoses as reported by the participants could be interpreted as possibly vestibular.

Compared with participants with nonvestibular dizziness, more participants with vestibular vertigo reported sick leave (40.6% vs 14.7% of those working at the time, $P<.001$), avoiding leaving the house (18.5% vs 10.1%; $P=.001$), and interruption of daily activities because of their symptoms (40.3% vs 11.5%; $P<.001$). For the overall group with dizziness/vertigo, the percentages were 20.7%, 12.2%, and 18.8%, respectively. We defined severely impairing symptoms as those leading to sick leave, medical consultation, or interruption of daily activities and found 80% of such symptoms in the group with vestibular vertigo, 57% in the group with nonvestibular dizziness, and 63% in the overall group with dizziness/vertigo. Both vestibular vertigo and nonvestibular dizziness were associated with reduced age- and sex-adjusted quality of life scores both in physical and mental quality of life domains measured with the SF-8 compared with control subjects in the general population without dizziness (**Figure**).

We investigated the association of medical consultations for dizziness/vertigo with age, sex, secondary school educational achievement level, type of dizziness (vestibular vertigo vs nonvestibular dizziness), single vs recurrent and duration of attacks. Participants with vestibular vertigo were more likely to consult a physician than were participants with nonvestibular dizziness (adjusted odds ratio, 1.50; 95% confidence interval, 1.06-2.14), and the association of medical consultation with most other variables differed by type of dizziness and is, therefore, reported separately for vestibular vertigo and nonvestibular dizziness (**Table 3**). For nonvestibular dizziness, older age, female sex, and duration of attacks longer than 1 minute were associated with consulting a physician. For vestibular vertigo, no factors were associated with consulting a physician (recurrent attacks were marginally nonsignificant).

COMMENT

Dizziness is recognized as a highly prevalent symptom in the community[3,19,20] and the principal reason that 2.6% of patients aged 25 years or older are seen in primary care practices in the United States according to an older analysis of the National Ambulatory Medical Care Survey.[6] However, the contribution of vestibular vertigo to the burden of dizziness in the general population may have been underestimated thus far because previous studies with

Table 3. Factors Associated With Consulting a Physician Because of Dizziness or Vertigo

Variable	Adjusted by Age and Sex		Multivariate Analysis[a]	
	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
Medical consultation because of nonvestibular dizziness				
Age, y[b]	1.31 (1.20-1.44)	<.001	1.22 (1.09-1.37)	<.001
Female sex	1.52 (1.12-2.06)	.008	1.63 (1.16-2.29)	.005
Recurrent vertigo	1.72 (0.76-3.87)		2.28 (0.90-5.72)	.081
Duration of episodes				
1-60 s	1 [Reference]	<.001[c]	1 [Reference]	<.001[c]
>1-60 min	2.00 (1.42-2.82)	<.001	1.96 (1.35-2.84)	<.001
>60 min	6.16 (2.66-14.26)	<.001	4.72 (1.86-11.98)	.001
Variable	1.50 (0.68-3.29)	.30	1.18 (0.27-2.68)	.70
Secondary school education, y				
>10	1 [Reference]	.04[c]	1 [Reference]	.05[c]
10	1.37 (0.95-1.97)	.01	1.38 (0.94-2.01)	.02
<10	1.67 (1.11-2.52)	.09	1.65 (1.08-2.51)	.10
Medical consultation because of vestibular vertigo				
Age[b]	1.25 (1.05-1.52)	.01	1.19 (0.96-1.46	.10
Female sex	1.04 (0.55-1.97)	.90	0.97 (0.50-1.90)	.90
Recurrent vertigo	2.92 (1.11-7.70)	.03	2.80 (0.94-8.30)	.06
Duration of attacks				
1-60 s	1 [Reference]	.80[c]	1 [Reference]	.60[c]
>1-60 min	0.75 (0.37-1.51)	.40	0.77 (0.36-1.62)	.50
>60 min	1.15 (0.55-2.41)	.70	1.43 (0.59-3.46)	.40
Variable	1.00 (0.28-3.53)	>.99	0.89 (0.23-3.41)	.90
Secondary school education, y				
>10	1 [Reference]	.80[c]	1 [Reference]	.80[c]
10	1.27 (0.60-2.65)	.50	1.23 (0.59-2.78)	.50
<10	1.08 (0.52-2.23)	.80	1.06 (0.50-2.27)	.90

Abbreviations: CI, confidence interval; OR, odds ratio.
[a] Model including all variables in the table.
[b] Odds ratio for a 10-year increase in age.
[c] *P* value for trend.

unselected samples were generally conducted with lay interviewers or written, fully standardized questionnaires and were, thus, limited to symptom description and not neurotologically validated differentiation of vestibular vertigo from nonvestibular dizziness.[3,19,20] This differentiation is valuable in primary care because it narrows the list of possible causes of dizziness and improves the diagnostic process. However, data on the incidence of a first episode of dizziness and vertigo across age groups in medical practice has been lacking, possibly leading to underestimation of dizziness as a symptom prompting a diagnostic workup.

Our study reassesses the burden of dizziness in the general population and, to our knowledge, estimates for the first time the percentage of adults who seek medical care annually with the new symptom of moderate or severe dizziness or vertigo (1.8%). This finding has relevance for patient care because it shows that dizziness/vertigo is a frequent reason for performing a diagnostic workup. Medical conditions that cause dizziness and vertigo are heterogeneous and often require multidisciplinary investigation, which can be improved by knowledge of the frequency of specific disorders.[13] A first diagnostic finding that may prompt further investigation is provided by the differentiation of vestibular vertigo from nonvestibular dizziness. According to our study results, vestibular vertigo accounts for one-third of dizziness/vertigo symptoms in the medical setting. This finding is in line with the results of a critical review of the few existing studies of patients with dizziness who seek medical care, which estimated that more than half the diagnoses of dizziness in the medical setting are vestibular vertigo that were based on more selective and heterogeneous samples.[21] Thus, more attention should be given in primary care to frequent vestibular disorders, in particular, to benign paroxysmal positional vertigo, for which effective and inexpensive treatment with positioning maneuvers is available and easy to perform not only by specialists but also those in primary care.[22]

The design of this study did not allow a specific diagnosis for each patient. Based on diagnostic criteria that have been adapted to an interview situation through piloting and validation and that intentionally emphasize specificity rather than sensitivity, we conservatively estimated that in participants with vestibular vertigo 33% had benign paroxysmal positional vertigo (8% of all participants with dizziness), 33% had benign paroxysmal positional vertigo.[9] This was the most frequent vestibular diagnosis both in our study and in clinical case series.[11] Migrainous vertigo was diagnosed in 14% of participants with vestibular vertigo[7] (3% of all participants with dizziness) and was the second most common vestibular diagnosis. Migrainous vertigo is only beginning to be perceived by the medical community as a nosologic entity and is seldom diagnosed in studies that do not prospectively evaluate patients for vertigo caused by migraine.[21]

However, our finding that migrainous vertigo is a much more common condition is in line with large consecutive patient series that systematically and prospectively considered this diagnosis.[23,24]

Only 1 participant was found to have Meniere disease,[15] but this was not surprising because Meniere disease is a rare condition at the general population level.[11] Vestibular diagnoses, which by design have not been identified in this study, are so-called probable migrainous vertigo, which may occur similarly as frequently as migrainous vertigo,[11] vestibular neuritis, and rare diagnoses such as the various causes of central vertigo, perilymph fistula, autoimmune ear disease, vertebrobasilar transient ischemic attacks, or vascular compression of the eighth cranial nerve. It is a common experience in clinics that specialize in dizziness that in a percentage of cases a specific diagnosis cannot be made.

The strengths of our study are its large sample size; population-based design; comprehensive quality control provisions; and nationwide representativeness with regard to age, sex, and regional distribution. Furthermore, the results are based on validated neurotologic interviews. The response rate was good, and we investigated the potential effect of nonresponse at all levels where nonresponse occurred, with reassuring results with respect to selection bias.[14] The only exception was that participants with lower educational achievement levels were underrepresented in the GNT-HIS. However, inasmuch as GNT-HIS participants with lower educational achievement levels had a higher prevalence of dizziness/vertigo and were more likely to consult a physician because of dizziness/vertigo, our conclusions seem robust.

Several limitations of our data are noteworthy. Recall bias could have occurred, leading to underestimation of singular or more remote episodes of dizziness. Misclassification may also have occurred despite a thorough piloting and validation process of the interview, extensive training of the interviewers, and case conferences for each participant in the study. However, because the study criteria for vestibular vertigo emphasized specificity, misclassification is likely to result in underestimation of the prevalence and incidence of vestibular vertigo. Another limitation is that when a participant had vestibular vertigo, we did not inquire in detail about additional reactive or comorbid nonvestibular dizziness. Therefore, we do not present prevalence and incidence estimates for nonvestibular dizziness.

It may seem surprising at first glance that 42% of participants with dizziness/vertigo never consulted a physician despite reporting symptoms of at least moderate severity. However, similar findings have been reported for migraine, with only 31% of affected individuals ever consulting a physician because of headache.[25] The percentage of participants with dizziness who did not consult a general practitioner was even higher in 2 studies that included mild dizziness (60% and 77%, respectively).[19,20] Little is known about the factors that prompt patients to seek medical treatment of dizziness. In accordance with a previous study, we found that patients with vertigo are more likely to consult a physician than are patients with nonvertiginous dizziness.[19] Consultation because of nonvestibular dizziness increased with age and duration of attacks and was more frequent in women; however, these factors were not relevant for vestibular vertigo. For both vestibular vertigo and nonvestibular dizziness, specialist consultation rates in Germany are likely to be higher than in other countries because patient self-referral to specialists is easy and widespread.

Dizziness/vertigo and, in particular, vestibular vertigo had a considerable personal effect on those affected, including a lower health-related quality of life compared with dizziness-free control subjects in the general population. These results confirm at a population level findings from clinical case series of patients with dizziness and vertigo who had lower health-related quality of life measured with both generic and disease-specific instruments compared with dizziness-free control subjects.[26] In addition, 10% of participants with nonvestibular dizziness and almost 20% of those with vestibular vertigo reported avoiding leaving the house. This finding is not surprising because an association of both of these symptoms with anxiety has been shown.[27,28] Despite the high prevalence of dizziness across all age groups, to our knowledge, only a few studies have investigated the consequences of dizziness in unselected individuals and none has compared vestibular vertigo with nonvestibular dizziness. In a study including more than 15 000 participants from the general population aged 14 years to older than 75 years, dizziness prevented 22% of affected individuals from performing normal daily activities for 1 day or longer.[20] In another similarly large study, dizziness substantially interfered with activities or led to medication intake or physician visits in 73% of cases.[3] In a study with working-age participants, dizziness caused some degree of handicap in 47% and occupational difficulties in 40% of those working at the time.[19] Furthermore, chronic dizziness in a geriatric population was associated with worsening self-reported health and other functional and psychological outcomes.[29] Comparisons with our results are hampered by different selection of study participants and questionnaire wording; however, overall, these studies show that dizziness is not a harmless symptom in a relevant percentage of individuals.

In summary, our study shows that both dizziness and vertigo are frequent symptoms in general practice that inflict a considerable health care burden. On a personal level, dizziness and vertigo disorders are associated with lower quality of life in affected individuals compared with dizziness-free control subjects and may interfere with individual lifestyle and social behavior. The underestimation of dizziness and vertigo symptoms with regard to their effect on personal and health care is reflected in the fact that large percentages of the underlying disorders remain underdiagnosed and, therefore, are presumed to be insufficiently treated. Vestibular vertigo is a frequent reason for consultation in primary care, and its effect at the general population level may have been underestimated. Broadening epidemiologic data on the high frequency of both vestibular vertigo and nonvestibular dizziness may help enhance clinician awareness of these disorders and subsequently improve the recognition, differential diagnostic workup, and effective treatment in the large group of patients with dizziness and vertigo.

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REFERENCES

1. Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJ. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. *Lancet*. 2006;367(9524):1747-1757.
2. Kroenke K, Mangelsdorff AD. Common symptoms in ambulatory care: incidence, evaluation, therapy, and outcome. *Am J Med*. 1989;86(3):262-266.
3. Kroenke K, Price RK. Symptoms in the community: prevalence, classification, and psychiatric comorbidity. *Arch Intern Med*. 1993;153(21):2474-2480.
4. Madlon-Kay DJ. Dizziness: state of the science. *J Fam Pract*. 1985;21(2):109-113.
5. Bird JC. An analysis of referral patterns for dizziness in the primary care setting. *Br J Gen Pract*. 1998;48(437):1828-1832.
6. Sloane PD. Dizziness in primary care: results from the National Ambulatory Medical Care Survey. *J Fam Pract*. 1989;29(1):33-38.
7. von Brevern M, Radtke A, Lezius F, et al. Epidemiology of benign paroxysmal positional vertigo: a population-based study. *J Neurol Neurosurg Psychiatry*. 2007; 78(7):710-715.
8. Neuhauser HK, Radtke A, von Brevern M, et al. Migrainous vertigo: prevalence and impact on quality of life. *Neurology*. 2006;67(6):1028-1033.
9. Eckhardt-Henn A, Dieterich M. Psychiatric disorders in otoneurology patients. *Neurol Clin*. 2005;23(3):731-749.
10. Sloane PD, Coeytaux RR, Beck RS, Dallara J. Dizziness: state of the science. *Ann Intern Med*. 2001;134(9, pt 2):823-832.
11. Neuhauser HK. Epidemiology of vertigo. *Curr Opin Neurol*. 2007;20(1):40-46.
12. Bath AP, Walsh RM, Ranalli P, et al. Experience from a multidisciplinary "dizzy" clinic. *Am J Otol*. 2000;21(1):92-97.
13. Lurie JD, Sox HC. Principles of medical decision making. *Spine*. 1999;24(5):493-498.
14. Neuhauser HK, von Brevern M, Radtke A, et al. Epidemiology of vestibular vertigo: a neurotological survey of the general population. *Neurology*. 2005;65 (6):898-904.
15. Radtke A, von Brevern M, Feldmann M, et al. Screening for Menière's disease in the general population: the needle in the haystack. *Acta Otolaryngol*. 2008; 128(3):272-276.
16. Radtke A, Neuhauser H, von Brevern M, et al. Clinical consequences of orthostatic dizziness in the general population [abstract]. *Aktuelle Neurologie*. 2004; 31:S64.
17. Turner-Bowker DM, Bayliss MS, Ware JEJ, Kosinski M. Usefulness of the SF-8 Health Survey for comparing the impact of migraine and other conditions. *Qual Life Res*. 2003;12(8):1003-1012.
18. Wilson EB. Probable inference, the law of succession, and statistical inference. *J Am Stat Assoc*. 1927;22(158):209-212.
19. Yardley L, Owen N, Nazareth I, Luxon L. Prevalence and presentation of dizziness in a general practice community sample of working age people. *Br J Gen Pract*. 1998;48(429):1131-1135.
20. Hannaford PC, Simpson JA, Bisset AF, Davis A, McKerrow W, Mills R. The prevalence of ear, nose and throat problems in the community: results from a national cross-sectional postal survey in Scotland. *Fam Pract*. 2005;22(3):227-233.
21. Kroenke K, Hoffman RM, Einstadter D. How common are various causes of dizziness? a critical review. *South Med J*. 2000;93(2):160-167.
22. Lempert T, von Brevern M. Episodic vertigo. *Curr Opin Neurol*. 2005;18(1):5-9.
23. Neuhauser H, Leopold M, von Brevern M, Arnold G, Lempert T. The interrelations of migraine, vertigo, and migrainous vertigo. *Neurology*. 2001;56(4):436-441.
24. Brandt T. A chameleon among the episodic vertigo syndromes: "migrainous vertigo" or "vestibular migraine." *Cephalalgia*. 2004;24(2):81-82.
25. Lipton RB, Scher AI, Kolodner K, Liberman J, Steiner TJ, Stewart WF. Migraine in the United States: epidemiology and patterns of health care use. *Neurology*. 2002;58(6):885-894.
26. Fielder H, Denholm SW, Lyons RA, Fielder CP. Measurement of health status in patients with vertigo. *Clin Otolaryngol Allied Sci*. 1996;21(2):124-126.
27. Margraf J, Taylor B, Ehlers A, Roth WT, Agras WS. Panic attacks in the natural environment. *J Nerv Ment Dis*. 1987;175(9):558-565.
28. Eagger S, Luxon LM, Davies RA, Coelho A, Ron MA. Psychiatric morbidity in patients with peripheral vestibular disorder: a clinical and neuro-otological study. *J Neurol Neurosurg Psychiatry*. 1992;55(5):383-387.
29. Tinetti ME, Williams CS, Gill TM. Health, functional, and psychological outcomes among older persons with chronic dizziness. *J Am Geriatr Soc*. 2000; 48(4):417-421.

uity stake or interest in GlaxoSmithKline. Drs Clark and Williams are employees of GlaxoSmithKline and hold equity in the company.

1. Hall SA, Araujo AB, Esche GR, et al. Treatment of symptomatic androgen deficiency: results from the Boston Area Community Health Survey. *Arch Intern Med*. 2008;168(10):1070-1076.
2. Bhasin S, Cunningham GR, Hayes FJ, et al. Testosterone therapy in adult men with androgen deficiency syndromes: an endocrine society clinical practice guideline. *J Clin Endocrinol Metab*. 2006;91(6):1995-2010.
3. Araujo AB, Esche GR, Kupelian V, et al. Prevalence of symptomatic androgen deficiency in men. *J Clin Endocrinol Metab*. 2007;92(11):4241-4247.
4. Tan RS, Salazar JA. Risks of testosterone replacement therapy in ageing men. *Expert Opin Drug Saf*. 2004;3(6):599-606.
5. Araujo AB, O'Donnell AB, Brambilla DJ, et al. Prevalence and incidence of androgen deficiency in middle-aged and older men: estimates from the Massachusetts Male Aging Study. *J Clin Endocrinol Metab*. 2004;89(12):5920-5926.
6. McKinlay JB, Travison TG, Araujo AB, Kupelian V. Male menopause: time for a decent burial? *Menopause*. 2007;14(6):973-975.
7. Araujo AB, Kupelian V, Page ST, Handelsman DJ, Bremner WJ, McKinlay JB. Sex steroids and all-cause and cause-specific mortality in men. *Arch Intern Med*. 2007;167(12):1252-1260.
8. Araujo AB, Travison TG, Leder BZ, McKinlay JB. Correlations between serum testosterone, estradiol, and sex hormone-binding globulin and bone mineral density in a diverse sample of men. *J Clin Endocrinol Metab*. 2008;93(6):2135-2141.
9. Araujo AB, Travison TG, Bhasin S, Esche GR, Williams RE, Clark RV, McKinlay JB. Association of testosterone and estradiol with age-related declines in physical function in a diverse sample of men. *J Am Geriatr Soc*. In press.
10. Travison TG, Shackelton R, Araujo AB, et al. The natural history of symptomatic androgen deficiency in men: onset, progression, and spontaneous remission. *J Am Geriatr Soc*. 2008;56(5):831-839.

Correction

Errors in Abstract, Text, and Table. In the Original Investigation titled "Burden of Dizziness and Vertigo in the Community" by Neuhauser et al, published in the October 27 issue of the *Archives* (2008;168[19]:2118-2124), errors occurred in the abstract on page 2118, in the text on page 2122, and in Table 3 on page 2122. In the abstract, the second and third sentences of the "Results" section should have read as follows: "For vestibular vertigo, the prevalence was 4.9% and the incidence was 1.4%. We also found that 1.8% of unselected adults consulted a physician in the last 12 months for incident dizziness/vertigo (0.9% for vestibular vertigo)." On page 2122, in the right-hand column, second paragraph, the second sentence should have read as follows: "Based on diagnostic criteria that have been adapted to an interview situation through piloting and validation and that intentionally emphasize specificity rather than sensitivity, we conservatively estimated that in participants with vestibular vertigo 33% had benign paroxysmal positional vertigo (8% of all participants with dizziness).[9]" Also on page 2122, in Table 3, the sixth entry in the first column should have read "Duration of attacks." The journal regrets these errors.