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## Dizziness among Older Adults: A Possible Geriatric Syndrome

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**Background:** In previous studies of dizziness, the prevalence of specific causes has varied widely and either no or multiple causes have been identified. Dizziness might be better considered a geriatric syndrome that results from impairment or disease in multiple systems.

**Objective:** To determine the predisposing characteristics and situational factors associated with dizziness.

**Design:** Population-based, cross-sectional study.

**Setting:** Community.

**Participants:** Probability sample of 1087 community-living persons in New Haven, Connecticut, who were at least 72 years of age.

**Measurements:** Episodes of dizziness that occurred for at least 1 month; manifestations of dizziness; and predisposing demographic, medical, neurologic, sensory, and psychological characteristics.

**Results:** 261 participants (24%) reported dizziness; 56% of dizzy persons described several sensations and 74% reported several triggering activities. The adjusted relative risks for characteristics associated with dizziness were 1.69 (95% CI, 1.24 to 2.30) for anxiety, 1.36 (CI, 1.02 to 1.80) for depressive symptoms, 1.27 (CI, 0.99 to 1.63) for impaired hearing, 1.30 (CI, 1.01 to 1.68) for five or more medications, 1.31 (CI, 0.92 to 1.87) for postural hypotension, 1.34 (CI, 0.95 to 1.90) for impaired balance, and 1.31 (CI, 1.00 to 1.71) for past myocardial infarction. The adjusted relative risk for dizziness was 1.38 (CI, 1.27 to 1.49) for each additional characteristic.

**Conclusions:** The association among characteristics in multiple domains (cardiovascular, neurologic, sensory, psychological, and medication-related) and dizziness, coupled with the multiplicity of sensations and triggering activities, suggests that dizziness may be a geriatric syndrome, similar to delirium and falling. If so, an impairment reduction strategy, proven effective for other geriatric syndromes, may be effective in reducing the symptoms and disabilities associated with dizziness.

Dizziness is a well-recognized problem among older persons. The reported prevalence ranges from 13% to 38%, depending on the definition used and the population studied (1–5). Dizziness has been associated with increased risk for falls and with syncope, functional disability, nursing home placement, stroke, and death (1, 2, 4–10). Given the frequency of dizziness and its associated morbidity, much attention has focused on identifying the causes of dizziness.

In most previous etiologic studies, investigators assumed that dizziness was a symptom of one or more discrete diseases. These studies often involved select groups of participants, usually persons referred to specialty clinics or centers (9–18). After thorough evaluation, investigators typically assigned the cause of the dizziness to specific diagnostic categories on the basis of clinical judgment or diagnostic algorithms. Diagnostic findings from these studies have varied greatly. For example, vestibular disease was identified as a primary or contributing cause in 4% to 64% of cases of dizziness (9, 14, 15, 17, 18). Similarly, cerebrovascular causes were identified in 0% to 70% of cases, psychiatric causes in 0% to 40%, and cervical spondylosis in 0% to 66% (11–18). In one study, carotid hypersensitivity was diagnosed in 48% of participants (17). The frequency with which no diagnosis could be made has ranged from 8% to 22% of cases, whereas multiple diagnoses have been assigned in 0% to 85% of cases (11–18).

These discrepant findings among studies are probably due in part to the different populations studied and the disparate criteria used in assigning diagnoses. The great variability in the prevalence of specific diagnoses and the frequency with which no diagnosis or multiple diagnoses were made, however, raises the possibility that considering dizziness solely as a symptom of discrete diseases may not be

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the optimal clinical strategy. Indeed, investigators have acknowledged the limitations of the current diagnosis-oriented approach and have expressed the need for strategies that may more effectively reduce the symptoms and disability associated with dizziness (19). Considering dizziness a geriatric syndrome might lay the groundwork for such a strategy. Geriatric syndromes are multifactorial health conditions that occur when the accumulated effect of impairments in multiple systems renders a person vulnerable to situational challenges (20–22).

Results from previous community-based studies of older persons support a possible multifactorial cause of dizziness. Associated risk factors have included various combinations of angina; myocardial infarction; stroke; Parkinson disease; arthritis; diabetes; syncope; neurosensory impairments; alcohol consumption; smoking; nervousness; and use of several classes of medications, including diuretics, anti-convulsants, anxiolytics, and antidepressants (1–3, 5, 12). Although the results are suggestive, these studies involved select samples (2, 3) or included only a limited spectrum of factors, which were usually ascertained by self-report rather than examination (1, 4, 5, 12).

In the context of considering dizziness as a possible geriatric syndrome, the aims of our study, which was conducted in a representative cohort of community-living older persons, were to determine the prevalence of episodes of dizziness that had been occurring for at least 1 month, to identify potential characteristics that predispose to dizziness, and to identify situational factors (such as sensations or activities) reported to be present at the time of the dizziness.

## Methods

### Participants

Participants were members of a previously described probability sample of community-living persons 72 years of age or older residing in New Haven, Connecticut (23). First, a census was taken of all 2483 age-restricted housing units. Next, every 62nd non-age-restricted house or apartment was sampled, and the next 12 units were included in the study. A total of 1436 age-eligible persons not enrolled in another longitudinal study were identified in enumerated households between October 1989 and August 1990. Forty-four of these persons (3%) were ineligible because they did not speak English, Spanish, or Italian; could not follow simple commands; or were not ambulatory within their own household. Of the 1392 eligible participants, 1103 (79%) agreed to be enrolled in the cohort. Of these, 1070 were interviewed in English, 23 in Spanish, and 7 in Italian. Language information was not

recorded for 3 participants. The 1087 (99%) cohort members who completed questions on dizziness during the baseline interview were included in the present study.

### Descriptive Data and Potential Predisposing Characteristics

Demographic data, including age, sex, ethnicity, education, income, and living situation, were obtained during baseline interviews in participants' homes. Participants were asked whether a physician had ever told them that they had any of the following diseases: diabetes mellitus, myocardial infarction, cancer, stroke, Parkinson disease, or arthritis. Hospitalizations in the year before the interview were ascertained from direct monthly surveillance of the two acute-care hospitals in New Haven, Connecticut, and from Health Care Financing Administration data. Cohort members were matched to Health Care Financing Administration files, and hospitalizations were ascertained from Medical Provider Analysis and Review files. Interviewers recorded participants' medications (both prescription and nonprescription) directly from the containers. The Iowa coding and categorization system was used to classify types of medication (24). Alcohol consumption was ascertained by using a standard questionnaire (25). Cognitive status was assessed by using the Folstein Mini-Mental State Examination (26). The Center for Epidemiologic Studies–Depression test (27) was used to ascertain depressive symptoms, and the State-Trait Anxiety Inventory (28) was used to evaluate anxiety. Acuity of corrected near vision was assessed by using the Rosenbaum card, and the percentage of visual impairment was calculated (29). Hearing was assessed by using the whisper test (30). Blood pressure and heart rate were measured after the participants had rested supine for at least 5 minutes. A standard sphygmomanometer with an appropriate-sized (regular, pediatric, or large) cuff was used. After blood pressure and heart rate were measured, the participant was helped into a standing position. His or her arm was placed on a portable stand that was level with the heart, and blood pressure and heart rate measurements were repeated immediately after standing and after 2 minutes. Balance and gait maneuvers were side-by-side, tandem, and one-leg stands; the time required to turn a circle while standing in place; step symmetry and continuity; path deviation; and turning while walking (31).

### Dizziness

A two-step process was used to determine the presence of dizziness. First, participants had to respond positively to the question, "During the past 2 months, have you had episodes of feeling dizzy,

unsteady, or like you were spinning or moving, light-headed, or faint?" Second, to exclude persons with short-term illnesses associated with dizziness, the episodes of dizziness, whether intermittent or persistent, had to be present for at least 1 month. Participants who met these two criteria were asked to identify the positions or activities that were associated with episodes of their dizziness and the sensations that best described their dizziness. As articulated by Drachman (32, 33), the four categories of sensation were 1) losing balance without an abnormal sensation in the head (disequilibrium or unsteadiness), 2) near faint ("feeling like you're going to pass out"), 3) going around or a perception of movement (vertigo or spinning), or 4) sensations other than these three. We avoided the term "light-headed" to force the choice of a more precise term. Because the patterns of dizziness that participants experienced varied, the duration and frequency of the dizzy episodes were also ascertained.

### Statistical Analyses

The weighted and unweighted prevalence rates for dizziness and characteristics of dizziness were calculated, the former by using SUDAAN, version 7.0 (34). Because the weighted and unweighted prevalence rates and associated 95% CIs were very similar, both are provided only for the occurrence of dizziness, and only the unweighted prevalence rates are provided for the remaining dizziness variables. For continuous variables, the Wilcoxon rank-sum test was used to make bivariate comparisons of participants with and those without dizziness. Categorical variables were compared by using chi-square tests or the Fisher exact test in the case of small cell sizes (expected value < 5). All comparisons were two-tailed.

For multivariable analyses, the adjusted relative risks and 95% CIs were estimated from a generalized linear model by using a log link and a binomial error structure with adjustment to ensure that the predicted probabilities remained in the range of 0 to 1 (35). The models were fitted by using the GENMOD procedure in SAS, version 6.12 (36). To account for the stratified sampling design, all multivariable analyses were adjusted for housing type (non-age-restricted, public age-restricted, and private age-restricted). Demographic variables were not included in the model because there was no reason to suspect that they would confound the relation between the candidate variables and dizziness and because these variables differed little between persons with and those without dizziness.

The primary criterion used in selecting variables for the multivariable model was the a priori likelihood, based on previous studies or clinical judgment, that the variable might be associated with

dizziness. We reduced the number of candidate variables by creating composite or cumulative variables. First, because the balance and gait items were correlated, a single balance item (time to turn in a circle) and a single gait item (path deviation) were added to create a composite balance and gait measure. Second, for chronic conditions and medications, cumulative variables were created. Because one of the variables in each of these domains was highly associated with dizziness in bivariate analysis ( $P < 0.001$ ), both the single variable and the cumulative variable, the latter excluding the single variable, were included in the multivariable model. On the basis of these criteria, the variables included in the model were past myocardial infarction, number of other chronic conditions, hospitalization in the year before the interview, postural hypotension (mean blood pressure decrease on standing  $\geq 20\%$ ), use of antidepressants, number of other medications, depressive symptoms (Center for Epidemiologic Studies–Depression), anxiety trait (State-Trait Anxiety Inventory), hearing impairment, and balance impairment (path deviation plus time to turn a circle).

To facilitate clinical interpretation and allow the calculation of relative risks, the continuous and categorical variables were dichotomized. Both Center for Epidemiologic Studies–Depression and State-Trait Anxiety Inventory were dichotomized at commonly accepted cut points; chronic conditions, medications, and time to turn a circle were dichotomized at the 75th percentile. Because substantial data were missing for two of the candidate variables—13% for depressive symptoms and 11% for anxiety—we used a multiple imputation technique to provide more efficient and less biased estimates than provided by other methods of handling missing data (37, 38). Briefly, including all variables from our multivariable model that were significantly correlated with anxiety or depressive symptoms, we used the Sampling Importance Resampling algorithm to generate five data sets with apparently complete data (39, 40). Our binomial regression models were repeated on each of these five data sets, and the results were combined as recommended by Rubin (41). On the basis of clinical judgment, the interactions tested were depressive symptoms and antidepressants, depressive symptoms and anxiety, and antidepressants and anxiety. None of the interaction terms were statistically significant.

In an additional binomial regression model, a count of the number of characteristics, each identified as having at least a marginal effect on the risk for dizziness in the multivariable model ( $P < 0.15$ ), was included as the independent variable. The model was adjusted for housing type and for characteristics not associated ( $P \geq 0.15$ ) with dizziness in

**Table 1. Frequency and Duration of Episodes of Dizziness in 248 Participants\***

Duration of Dizziness	Frequency of Episodes			Total
	Daily	Weekly	Monthly	
<1 minute	33	14	68	115
1 minute to 2 hours	40	20	51	111
Several hours	8	0	7	15
Constant when present	7	0	0	7
Total	88	34	126	248

\* Data on duration or frequency were missing for 13 participants.

the multivariable model. The resulting coefficient for the number of characteristics in this model can be interpreted as the log of the relative risk for each additional characteristic.

Because dizziness is often categorized into four groups of sensation (loss of balance, near faint, spinning or movement, or other or multiple sensations [32, 33]), we determined the number of characteristics identified in the preceding model according to type of sensation. Then, by using analysis of variance, we compared the mean number of characteristics across the four dizziness groups and between each of the four dizziness groups and the group without dizziness.

## Results

Of the 1087 participants, 310 (29%) reported dizziness in the 2 months before the interview (weighted result, 28% [95% CI, 24% to 32%]). Of these 310 participants, 261 (24%) reported having dizziness for more than 1 month (weighted result, 23% [CI, 20% to 27%]). The episodes of dizziness had been occurring for at least 1 year in 164 persons (63%) (weighted result, 58% [CI, 50% to 67%]). The frequency and duration of the episodes of dizziness are shown in **Table 1**. Substantial heterogeneity was seen in both the frequency and the duration of episodes.

The sensations and positions or activities reported as occurring during episodes of dizziness are shown in **Table 2**. Forty-four percent of participants described a single sensation for their dizziness, and 56% described multiple sensations. The most frequently mentioned sensation was loss of balance, disequilibrium, or unsteadiness, which was reported by 154 persons (59%). Most participants (74%) reported several positions or activities that were associated with the occurrence of dizziness. Getting up from a lower position (either lying down or sitting), turning (either the head or the entire body), and being upset or anxious were the most frequently cited triggering activities.

The characteristics of participants with and those without dizziness are shown in **Table 3**. In bivariate

analysis, several medical, psychological, sensory, and balance characteristics were associated with an increased risk for dizziness. Of note, when defined by systolic blood pressure changes alone, postural hypotension was not associated with dizziness, regardless of the cutoff used. On the other hand, a decrease in mean blood pressure of at least 20%, either immediately or at 2 minutes, was associated with dizziness ( $P = 0.009$ ).

The seven characteristics associated with dizziness in the multivariable model are shown in **Table 4**. Among participants with none of these seven characteristics, only 10% (20 of 200) reported dizziness. This proportion was 18% (42 of 237) among persons with one characteristic, 27% (56 of 206) among persons with two characteristics, 33% (46 of 139) among persons with three characteristics, 50% (40 of 80) among persons with four characteristics, and 68% (13 of 19) among persons with five or more characteristics. The adjusted relative risk for dizziness was 1.38 (CI, 1.27 to 1.49) for each additional characteristic.

Because both depressive symptoms and antidepressant use were identified as significant characteristics in bivariate analyses, we further examined the relation among depressive symptoms, antidepressant use, and dizziness in stratified analyses. Nineteen percent (134 of 718) of participants with-

**Table 2. Sensations and Positions or Activities Reported by 261 Older Persons with Dizziness**

Characteristic	Participants, n (%)
Sensations reported as dizziness	
Single sensation	114 (44)
Multiple sensations	146 (56)
Specific sensations reported	
Loss of balance (disequilibrium, unsteadiness)	154 (59)
Only sensation	58 (22)
Plus other sensations	96 (37)
Spin (vertigo, perception of movement)	87 (33)
Only sensation	25 (10)
Plus other sensations	62 (24)
Near faint (like passing out, presyncope)	109 (42)
Only sensation	31 (12)
Plus other sensations	78 (30)
Other than above	44 (17)
Positions or activities associated with dizziness	
No activities	16 (6)
Single activity	53 (20)
Multiple activities	192 (74)
Positions or activities reported	
Getting up from lying down	140 (54)
Turning head	108 (41)
Turning body	98 (38)
Getting up from sitting	81 (31)
When upset	80 (31)
Walking	68 (26)
Head in a specific position	55 (21)
Standing still	42 (16)
Changing position in bed	41 (16)
During exercise	36 (14)
Missing a meal	35 (13)
Lying on one side	31 (12)
After eating	16 (6)

**Table 3. Characteristics of Study Participants according to Presence of Dizziness (n = 1087)\***

Characteristic	Dizziness		P Value
	Yes (n = 261)	No (n = 826)	
<b>Demographic</b>			
Median age (interquartile range), y	79 (75–83)	79 (75–83)	>0.2
Female, n (%)	189 (72)	604 (73)	>0.2
White, n (%)	213 (82)	701 (85)	>0.2
Median education (interquartile range), y	9 (7–12)	10 (8–12)	0.023
<b>Living situation, n (%)</b>			
Married	61 (23)	190 (23)	>0.2
With others	23 (9)	69 (8)	
Alone	177 (68)	567 (69)	
<b>Medical/health</b>			
Median chronic conditions (interquartile range), nt	2 (1–2)	1 (1–2)	<0.001
Diabetes, n (%)	44 (17)	121 (15)	>0.2
History of myocardial infarction, n (%)	55 (21)	96 (12)	<0.001
History of cancer, n (%)	50 (19)	139 (17)	>0.2
History of stroke, n (%)	17 (7)	41 (5)	>0.2
Hospitalization in past year, n (%)†	51 (20)	111 (13)	0.016
Median systolic blood pressure while lying down (interquartile range), mm Hg	148 (134–162)	150 (136–168)	0.037
Postural hypotension (mean decrease in blood pressure ≥ 20%), n (%)	29 (11)	51 (6)	0.009
<b>Alcohol consumed in past month, n (%)</b>			
None	172 (68)	467 (59)	0.020
≤10 oz	60 (24)	240 (30)	
>10 oz	20 (8)	91 (11)	
<b>Medications</b>			
Median medications (interquartile range), nt	4 (3–7)	3 (2–5)	<0.001
Any antihypertensive agent, n (%)	167 (64)	456 (55)	0.012
β-Blocker, n (%)	59 (23)	130 (16)	0.011
Calcium-channel blocker, n (%)	52 (20)	122 (15)	0.048
Angiotensin-converting enzyme inhibitor, n (%)	22 (8)	61 (7)	>0.2
Nitrates, n (%)	37 (14)	87 (11)	0.107
Cardiac glycoside, n (%)	45 (17)	104 (13)	0.057
Diuretic, n (%)	105 (40)	320 (39)	>0.2
Insulin, n (%)	15 (6)	29 (4)	0.110
Oral hypoglycemic agent, n (%)	21 (8)	62 (8)	>0.2
Benzodiazepine, n (%)	32 (12)	65 (8)	0.030
Antidepressant, n (%)†	15 (6)	16 (2)	<0.001
Opioid analgesic, n (%)	15 (6)	30 (4)	0.135
Nonsteroidal anti-inflammatory drugs, n (%)	47 (18)	137 (17)	>0.2
<b>Psychological</b>			
Median Folstein Mini-Mental State Examination score (interquartile range)	26 (22–28)	26 (22–28)	>0.2
<b>Depressive symptoms, n (%)†‡§</b>			
≥16	91 (35)	127 (15)	<0.001
<16	140 (54)	591 (72)	
Missing	30 (12)	108 (13)	
<b>Anxiety traits, n (%)†‡  </b>			
≥32	163 (63)	314 (38)	<0.001
<32	76 (29)	419 (51)	
Missing	22 (8)	93 (11)	
<b>Sensory, n (%)</b>			
Visual impairment > 50%	91 (36)	289 (36)	>0.2
Hearing impairment (>6 of 12 errors on the whisper test)	62 (24)	142 (17)	0.018
<b>Balance and gait, n (%)</b>			
Path deviation during walking	49 (19)	111 (14)	0.036
Impaired step symmetry	70 (27)	163 (20)	0.016
Inability to tandem stand	149 (58)	395 (49)	0.006
Turns circle in >4 seconds	106 (42)	251 (31)	0.001
Balance impairment (path deviation and turn circle in >4 seconds)	25 (10)	48 (6)	0.034

\* Comparisons were made by using the Wilcoxon rank-sum test for continuous variables and the chi-square or Fisher exact test for categorical variables.

† Characteristic included in multivariate model.

‡ All categories presented because >5% of data were missing. For all other characteristics, <5% of data were missing.

§ Measured by using the Center for Epidemiologic Studies–Depression test.

|| Measured by using the State-Trait Anxiety Inventory.

out depressive symptoms who were not taking antidepressants reported dizziness. This percentage was 46% (6 of 13) among participants without depressive symptoms who were receiving antidepressants, 41% (83 of 203) among those with depressive symptoms who were not receiving antidepressants, and 53% (8 of 15) among those with depressive symptoms who were receiving antidepressants.

We determined the relation between specific sen-

sations of dizziness and the number of the seven characteristics (Table 4) that participants reported. Results are shown in Table 5. No statistically significant difference was seen in the mean number of characteristics among dizzy persons in any of the four groups of sensations. On the other hand, each of the four groups of dizzy persons had a significantly greater mean number of characteristics than did persons without dizziness.

**Table 4. Baseline Characteristics Associated with Dizziness in Older Persons\***

Characteristic	Adjusted Relative Risk (95% CI)†
Anxiety trait (STAI score $\geq 32$ )	1.69 (1.24–2.30)
Depressive symptoms (CES-D score $\geq 16$ )	1.36 (1.02–1.80)
Impaired balance (path deviation and time to turn in a circle $>4$ seconds)	1.34 (0.95–1.90)
Past myocardial infarction	1.31 (1.00–1.71)
Postural hypotension (mean decrease in blood pressure $\geq 20\%$ )	1.31 (0.92–1.87)
Five or more medications	1.30 (1.01–1.68)
Impaired hearing	1.27 (0.99–1.63)

\* CES-D = Center for Epidemiologic Studies–Depression; STAI = State-Trait Anxiety Inventory.

† Estimated from the generalized linear model described in the Methods section. The relative risks were adjusted for all other characteristics in the model; for housing stratum (non-age-restricted, public age-restricted, or private age-restricted) to adjust for sampling design; and for the characteristics in the model that were not associated with dizziness ( $P > 0.15$ ), namely number of chronic conditions, hospitalization in the previous year, and use of antidepressant medication.

## Discussion

The proportion of participants reporting episodes of dizziness in the course of at least 1 month (24%) was similar to that reported in previous community-based studies (1–5). Seven characteristics, representing cardiovascular (past myocardial infarction, postural hypotension), sensory (hearing), neurologic (balance), and psychological (anxiety, depressive symptoms) domains, as well as the number of medications, were associated at least marginally with dizziness. Furthermore, the likelihood of reporting dizziness was strongly associated with the number of predisposing characteristics. Although we cannot establish a temporal or cause–effect relation between these characteristics and dizziness in this cross-sectional study, a relation between each characteristic and dizziness is biologically plausible, and each has been associated with dizziness in one or more previous studies.

Considerable heterogeneity was seen in the frequency and duration of dizzy episodes and in the sensations and triggering activities reported. As in

previous studies, most participants in our cohort reported more than one sensation and identified several activities or positions that triggered dizziness. The proportion of persons with the predisposing characteristics was similar across categories of sensations and across categories of duration and frequency (data not shown), suggesting that for many older persons with dizziness, particular sensations and manifestations may not have as specific a relation to individual etiologic diagnoses of the dizziness as was once thought (32, 33).

The association between the multiple predisposing characteristics and dizziness, coupled with the variability in frequency and duration and the multiplicity of sensations and triggering activities, suggests that dizziness may often be a multifactorial problem similar to other geriatric syndromes, such as falling, delirium, and urinary incontinence (21, 22). As with other geriatric syndromes, we did not find one single factor that had an overwhelmingly strong relation with dizziness; rather, several factors each had a moderate relation with dizziness. This is not surprising when one considers that dizziness is a perception of disequilibrium or instability that results from a mismatch among or malfunction in one or more of the multiple domains that contribute to stability (32, 33). The multifactorial nature of dizziness may account for, at least in part, the discrepancies in the frequency of reported causes in earlier studies—investigators may have identified only one of several possible contributing factors or diseases in individual patients—and the high percentage of persons in whom no single cause could be identified (19). Consideration of dizziness as a geriatric syndrome does not negate the possibility that a single disease may be primarily responsible for the dizziness in a subset of persons. Rather, because equilibrium and stability result from interactions among a wide range of domains, dizziness may result when a single system is severely impaired or when several

**Table 5. Number of Predisposing Characteristics according to Sensations Reported as Describing Dizziness\***

Characteristic	Sensations Reported as Dizziness*				Not Dizzy (n = 664)
	Loss of Balance (n = 50)	Near Faint (n = 27)	Spinning (n = 21)	Other or Multiple Sensations (n = 119)	
n	← n (%) →				
0	3 (6)	3 (11)	4 (19)	10 (8)	180 (27)
1	7 (14)	5 (19)	5 (24)	25 (21)	195 (29)
2	16 (32)	9 (33)	3 (14)	28 (24)	150 (23)
3	11 (22)	5 (19)	6 (29)	24 (20)	93 (14)
4	11 (22)	5 (11)	1 (5)	25 (21)	40 (6)
$\geq 5$	2 (4)	2 (7)	2 (10)	7 (6)	6 (1)
Mean $\pm$ SD†	2.5 $\pm$ 1.3	2.3 $\pm$ 1.5	2.0 $\pm$ 1.6	2.4 $\pm$ 1.4	1.5 $\pm$ 1.2

\* The first three columns in this category include participants who reported a single sensation only; the fourth column includes all other participants with dizziness. The numbers do not add to the total number of participants reporting dizziness because of missing data.

† In analysis of variance, none of the means differed significantly among the four dizziness groups ( $P > 0.15$  for all comparisons). Each of the dizziness groups, however, differed significantly from the group without dizziness ( $P < 0.05$  for all comparisons).

systems have impairments that each may range from mild to severe.

Several other findings deserve comment. As have other researchers, we found that the relation between postural hypotension and dizziness depended on the definition used (1). No relation was detected between a decrease in blood pressure and dizziness when systolic blood pressure measurement alone was used, regardless of whether the cutoff of 20 mm Hg or another cutoff (ranging from 10 to 40 mm Hg) was used. The relation was noted only for mean blood pressure change, either immediately or at 2 minutes, perhaps because this measure better correlates with cerebral perfusion.

The strong relation between number of medications and dizziness remained after adjustment for several relevant markers and indicators of illness and disease. Although we cannot establish a cause and effect between the medications and dizziness and cannot exclude the possibility of other confounders, these results support the need to review the possible role of medications in patients who have dizziness, given the potential for successful intervention.

As seen in other studies (5, 12, 16), the association among depressive symptoms, antidepressants, and dizziness was complex. Our results suggest that both depressive symptoms and antidepressants are associated with dizziness, although their effects are not clearly additive. Our ability to explore this relation further was hampered by the cross-sectional nature of the study and by the small numbers of participants receiving antidepressants.

Population-based sampling was a major strength of our study. We thus avoided the bias and selective sampling that occur with clinic-based studies. Furthermore, unlike several community-based studies, we had baseline data on a wide spectrum of possible contributing factors. Nonetheless, our study had limitations. First, although comprehensive, the list of potential impairments, diseases, and other predisposing factors was not exhaustive. Second, we had no data on whether participants sought medical care for their dizziness. It is not clear whether persons who do not seek medical care for chronic problems such as dizziness differ from those who do. Furthermore, no participant underwent technologically based evaluations, such as posturography, tilt-table testing, electronystagmography, or neuroimaging, or more specific examinations, such as carotid sinus massage or the Hallpike maneuver. Although these tests may have helped to identify the presence of specific causes in a subset of our participants, that was not the purpose of our study. Even with ancillary testing, however, the cause of dizziness has remained undiagnosed in many persons in earlier investigations (11).

Another limitation was that the data were collected during 1989 and 1990, when several commonly used medications either were not available or were just being introduced. Examples include selective serotonin reuptake inhibitors, angiotensin-converting enzyme inhibitors, and several calcium-channel blockers. We cannot, therefore, comment on whether these agents or other more recently introduced medications might be more or less associated with dizziness than medications used commonly during the period of this study. There is no reason to suspect, however, that the relation between the other predisposing characteristics and dizziness would have changed from the early 1990s to the present.

If verified, our results suggest that clinicians should perhaps focus not only on diagnosing one or a few discrete diseases but also on identifying potentially treatable contributing factors to dizziness. The appropriate content of such an assessment cannot be determined from the present study, but our results support assessment of cardiovascular disease history; depressive and anxiety symptoms; sensory, balance, and gait impairments; and postural blood pressure changes. A thorough review of medications should also be included. Although careful investigation is needed to determine whether such a multifactorial strategy would be effective in reducing the symptoms or frequency of dizziness, this approach has proven effective for other geriatric syndromes, including falling and delirium (42, 43).

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