



## Epidemiology of dizziness

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The epidemiology of dizziness is challenging due to the variety of descriptors, the variability of clinical presentation, differences in the setting of the clinical evaluation and diagnostic techniques, methods of reporting, and various biases in sampling and referral. We briefly review these challenges and then present an overview of the frequency of the symptom and the broad array of diagnoses that can cause it.

**Keywords:** vertigo, vestibular

### 1. INTRODUCTION

It has been stated that, “Dizziness is the quintessential symptom presentation in all of clinical medicine. It can stem from a disturbance in nearly any system of the body. Patient descriptions of the symptom are often vague and inconsistent” [1] and, because of this, “Dizziness is one of the most challenging symptoms in medicine. It is difficult to define, impossible to measure, a challenge to diagnose, and troublesome to treat” [2]. Due to the enormous range of possible causes, it is understandable that dizziness is a common human experience, yet it is rather difficult to ascertain exactly how common it is.

There are several reasons for this difficulty. The first is the variety of clinical presentations of “dizziness”, reflected by the broad range of descriptive terminology used by patients, clinicians and researchers. The second is difficulty in establishing a cause in many cases, which is made worse by the limited diagnostic tools available. The third is the range of ways in which dizziness is studied and reported in the medical and scientific literature, making results apparently discrepant from one another and difficult to compare. We will discuss each of these difficulties and find that it is nevertheless possible to provide qualified estimates for the prevalence of dizziness.

The first problem is that of variable clinical presentation and terminology. Deficits in other sensory modalities are generally easier to localize and characterize. For instance, deficits in vision (such as blurry vision, double vision, scotomata), abnormalities of hearing (hearing loss, sound distortion), and abnormalities in somatic sensation (pain in a joint, numbness in the feet), are usually simpler for a person to describe. In contrast, the descriptors for dizziness are numerous, and each term often has different meanings for different people. A small sample of descriptors commonly encountered in clinical practice include dizziness, unsteadiness, light-headedness, feeling faint, actual syncope, spinning,

vertigo, motion sickness, nausea, rocking, “I feel like I’m on a boat”, “my eyes lag behind my head movements”, “can’t feel my feet” and “my feet don’t do what I want them to”. Most clinicians are reluctant to rely on a single term offered by a patient, and will instead prefer that the patient provide a more detailed description of the sensation.

The second problem is that of securing a diagnosis. While many causes of dizziness can be established by history and physical examination, others—particularly neurologic and otologic aetiologies—may be more elusive. In some cases diagnostic testing may be helpful, but often the relevant equipment and expertise in interpreting results are not widely available. Sometimes even a thorough evaluation fails to identify a cause.

The third problem—the variability of reporting in the literature—is mostly a consequence of the first two problems. If dizziness of a single aetiology can be described by different patients in very different ways, and if the means for confirming the diagnosis are limited or absent, and if diagnostic criteria vary from one study to the next, then it is easy to see how studies can be fraught with biases, false positives and false negatives, inconsistencies and inappropriate comparisons.

There is no tool that can simultaneously and perfectly surmount these difficulties, but a reasonable strategy, as for any epidemiological study, involves being as explicit as possible about diagnostic criteria at all levels. For instance, a study whose point of departure is the clinical presentation should explicitly enumerate patients’ descriptions of their symptoms. A study exploring a specific aetiology or set of aetiologies should explicitly articulate what tools (whether physical examination or diagnostic testing) were used and how they were used. All types of studies should be explicit about their method of data collection and possible biases. We will proceed, bearing in mind that many studies do not meet these criteria well, and our conclusions can only be as good as the data from which they are drawn.

The present article is intended to serve as a brief overview of the epidemiology of the symptom of

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dizziness. It is neither an exhaustive review article nor a meta-analysis.

## 2. SURVEYS OF SYMPTOMS OF DIZZINESS IN THE GENERAL POPULATION

Several methods have been employed in an attempt to quantify the frequency with which the symptom of dizziness occurs. The studies most likely to be representative are those that survey the general population. Results can be difficult to interpret for several reasons, not the least of which is that occasionally the reporting methodology fails to distinguish adequately between “incidence” (the onset of a chronic disease, or the first episode of a recurrent disease, within a particular population during a specific period of time) versus “prevalence” (how many people in a particular population have the disease at a specific point in time or within a specific period of time).

### 2.1 Surveys, broad age range

Many of these studies use a questionnaire methodology aimed at the “general population”, though sometimes they are biased towards a particular medical subspecialty.

For instance, Hannaford et al. [3] sent an otolaryngological survey to 12,100 randomly selected households in Scotland, and received responses from 15,788 people. Of the respondents in this study, whose ages ranged from 14 to “over 75” years, 20.5% reported “dizziness in which things spin around”, 28.8% reported “unsteadiness, light-headedness or feeling faint”, and 13.3% reported “dizziness in which respondent seems to move”. The study questions asked whether a person had ever in his or her life experienced these symptoms. The study did not make clear how respondents overlap—in other words, whether a single person reports one, two or three of these types of distribution. If a random distribution is assumed, the average lifetime incidence of these types of “dizziness” would be 20.9%. The questionnaire asked about other otolaryngological symptoms, thus potentially biasing the responses collectively towards otologic diseases.

Mendel et al. [4] received mailed questionnaire responses from 2,547 randomly selected individuals in Sweden. The questionnaire asked, “Have you experienced: (1) dizziness or unsteadiness during the past year? (2) dizziness in the sense of rotation? (3) dizziness in the sense of rotation in combination with loss of hearing and tinnitus? (4) unsteadiness without a sense of rotation? (5) falls as a result of dizziness? (6) dizziness provoked by the movement of lying down?” The first of these questions specifies “during the past year”, while the remaining five questions do not, so it is unclear what time frame the respondents assumed for questions 2–6. The

third question asks whether the dizziness is associated with specific otologic symptoms (hearing loss and tinnitus), thereby introducing a bias towards several otologic disorders such as labyrinthitis and Ménière’s disease. Bearing these limitations and biases in mind, the study found that 21% of respondents reported dizziness—though again it is unclear whether respondents understood all of the questions to refer to 1-year incidence, or whether they assumed that questions 2–6 referred to lifetime incidence.

Neuhauser et al. [5] conducted a questionnaire study of 4,869 randomly selected people aged 18–79 years in Germany. The screening question was, “Did you ever experience moderate or severe dizziness or vertigo?” They reported a 12-month prevalence of 22.9%, and a 12-month incidence of 3.1%. The study population, as noted earlier, only included people who reported “moderate or severe dizziness or vertigo”, not mild symptoms.

Tamber et al. [6] drew on data from the Oslo Health Study, which received responses from 17,638 individuals in Sweden. The study asked about a broad range of health issues, and included the question of whether an individual had experienced “faintness or dizziness” in the past week. This study found a one-week prevalence of 28.7% in people of ages 30–76 years.

Wiltink et al. [7] conducted home interviews of 1,287 randomly selected people in Germany of ages 14–90 years using standardized questionnaires. The questionnaire identified dizziness “in the past four weeks”, using the German version of the Vertigo Symptom Scale, and quantified the intensity of the symptom intensity on a 6-point scale. The study found the 4-week prevalence of dizziness to be 15.8% of participants aged 14–90 years. The study also specifically asked about concomitant psychiatric symptoms such as anxiety.

### 2.2 Surveys, older age range

Aggarwal et al. [8] drew on data from a longitudinal study of randomly selected people aged 65 years and older in Chicago that was exploring risk factors for “Alzheimer’s disease and other chronic medical conditions”. Within this population, 6,158 people were interviewed in their homes. The screening question for dizziness was whether “they had ever been dizzy or light-headed”. In this population of people aged 65 years and older, the lifetime incidence of dizziness was 41.4%.

Agrawal et al. [9] drew on data from a cross sectional national survey of over 12,000 “civilian non-institutionalized people” in the USA. The study randomly selected from that population 5,086 individuals aged 40 years and older. The screening questions for dizziness were, “During the past 12 months, have you had dizziness

or difficulty with balance?” and “During the past 12 months, have you had difficulty with falling?” All individuals (apparently irrespective of their responses to the screening questions) were subjected to balance testing, which consisted of four testing conditions that were essentially modifications of the Romberg stance on various surfaces with eyes open and eyes closed. This study concluded that 35.4% of people age 40 years and older had “vestibular dysfunction”.

Gassman et al. [10] conducted a survey using a standardized questionnaire on 600 randomly selected patients aged 65 and older in Germany. The participants were questioned again 2 years after the first sample. At the second survey point, they found the 6-month prevalence of dizziness to be 29.2% of participants aged 65 years and older.

Gopinath et al. [11] drew upon data from the Blue Mountains prospective cross-sectional study of people older than 50 years in a region to the west of Sydney, Australia. The study was conducted via a door-to-door census by university-trained audiologists and inquired about aural symptoms (hearing loss and tinnitus) and dizziness. The presence of dizziness was judged by response to the single question, “Have you ever experienced any dizziness or unsteadiness in the past year?” and, if positive, follow-up questions characterized the symptom further. Of 2,751 participants older than age 49 years, the overall 1-year prevalence of dizziness was 36.5%.

Jonsson et al. [12] conducted a longitudinal cross-sectional study of 2011 people aged 70–90 years in Sweden using a written questionnaire whose screening question was, “Are you troubled by vertigo, dizziness, disturbed balance or general unsteadiness?” The results, stratified by age, reported an “overall prevalence” of dizziness at age 70 to be 36% of women and 29% of men, while at age 88–90 the overall prevalence was 51% of women and 45% of men.

Stevens et al. [13] drew on data from a national survey of 2,925 randomly selected people aged 50 years and older in England. This study used not only a questionnaire, but also a limited physical examination. The questionnaire asked, “How often do you have problems with dizziness when you are walking on a level surface?” The time frame of inquiry was not specified, so in its broadest interpretation this refers to lifetime incidence. The limited physical examination consisted of a scoring system for (1) regular Romberg stance, (2) a stance in which the “side of the heel of one foot [was] touching the big toe of the other foot”, and (3) a stance in which the feet were in contact, with one directly in front of the other. Each stance was to be maintained for 10 seconds. By the questionnaire criteria, 11.1% of people

experienced dizziness; by the limited physical examination criteria, 21.5% of people were unsteady.

### 2.3 Surveys, paediatric population

Very few surveys of the paediatric population have been published.

Humphriss et al. [14] drew on data from a longitudinal study of a birth cohort of children born over a 20 month period in the UK. At age 10 years, 6,965 children were interviewed. The screening question was, “Do you ever get dizzy? By dizziness I mean the feeling you get when you’re on a roundabout or when you spin round and round in a circle. Do you ever get that feeling when you’re not on a roundabout or not spinning around?” Four hundred children responded positively. From this the study concluded that the lifetime incidence of dizziness up to age 10 years was 5.7%.

Niemensivu et al. [15] conducted a questionnaire survey of 938 children aged 1 to 15 years from one child welfare unit and 3 schools in Helsinki. The authors state that they “use the word ‘vertigo’ for both vertigo and dizziness” and, although they do not list the specific screening question, they indicate that they collected information on “possible episodes of vertigo, disequilibrium, falls, clumsiness ... and episodes during which the child has been unable to walk”. Of these 938 children aged 1 to 15 years, 8% had experienced or exhibited dizziness.

### 2.4 Dizziness increases with aging

Most studies [3–6, 8–10, 12, 13, 16, 17] collect data on gender, stratify by age and find that the incidence and prevalence of dizziness tends to be more common in women and tends to increase with age. Table 1 illustrates the general increase in dizziness with age (allowing for differences in methodology between studies). Some of the studies report additional associations; for instance, Gassman et al. [10] report that “the main predictors of dizziness were [increasing] age, female gender, cardiovascular disease, osteoporosis, depression, sleep disorder, disturbance of memory, shortsightedness, incontinence, three or more medical conditions, four or more medications, poor health status, falls and mobility problems”.

### 2.5 Surveys of symptoms of dizziness in people who have already sought medical attention

An alternative approach to the epidemiology of dizziness is to study people who have sought medical attention for the symptoms. The advantage of this approach is that a more detailed characterization of symptoms is generally possible since the individuals have been interviewed by a



Table 1. The incidence and prevalence of dizziness generally increases with age.

Author	Sample size	Age range	Percentage of dizzy patients	Pertaining to
Humphriss (2011)	6965	10 years	5.7%	Lifetime incidence
Niemensivu (2006)	938	1 to 15 years	8%	Lifetime incidence
Agrawal (2009)	5086	40 years and above	35.4%	12 month prevalence
Gopinath (2009)	2751	50 years and above	36.5%	12 month prevalence
Stevens (2008)	2925	50 years and above	11.1%	Prevalence by questionnaire
			21.5%	Presence on physical examination
Gassman (2009)	600	65 years and above	29.2%	6 month prevalence
Aggarwal (2000)	6158	65 years and above	41.4%	Lifetime incidence
Jonsson (2004)	2011	70 years	36% women, 29% men	Overall prevalence
		88–90 years	51% women, 45% men	

medical professional. The disadvantage is that this approach introduces a sampling bias insofar as the study population is self-selecting for a symptom that is sufficiently bothersome or worrisome that it caused a person to seek medical care. In practice this type of study is either conducted by physicians or is accomplished by surveying physicians who see these patients.

For instance, data from 1985 found that in the USA, 7,879,936 patients aged 25 years and older presented to their primary care physicians with a chief complaint of dizziness [16]. In 1985 the USA population was 237.943 million [18]. In the closest year with census data stratified by age (1990) the percentage of the population that was aged 25 years and over was 63.66% [19], so there were approximately 151.475 million people aged 25 and older. This would mean that roughly 5.2% of the US population aged 25 years and older sought medical attention for dizziness.

Sloane et al. [16] drew on data from a national ambulatory medical care survey. The survey was questionnaire-based, in which responses were the patient's own words. Dizziness was judged to be present if patients used the words "vertigo, dizziness, falling sensation, giddiness, light-headedness, loss of sense of equilibrium or balance, room spinning". Across all ages, dizziness was listed as one of the top three presenting complaints in only 1.73% of patients. This number is surprisingly low, but may in part be the result of the broad age range (entire life span) and the self-selecting population.

Yardley et al. [20] recruited four medical practices in North London, which in turn randomly selected one in three patients aged 18–65 years from their census forms to receive questionnaires by mail. The questionnaire asked whether a patient had, in the previous month, experienced any "dizziness, giddiness, unsteadiness, or an

illusory sensation that the responder or things around the responder were moving. Information was then sought on the presence and duration of symptoms corresponding to four conventional categories: true vertigo; giddiness, light-headedness or wooziness; feeling about to faint or lose consciousness; feeling unsteady, off balance or about to fall or veer to one side". Questionnaires were sent to 5,326 individuals, of whom 1,522 (28.6%) responded. Of the respondents, 480 (23.3%) reported symptoms of dizziness in the past month.

### 3. DIAGNOSES

So far we have only discussed statistics predominantly regarding symptoms—i.e., a patient's report of dizziness. This does not address the more specific issue of the underlying cause—i.e., the diagnosis. Generally, statistics regarding diagnosis are only obtainable regarding patients who have sought medical attention. Of those people who actually do seek medical attention for dizziness, what types of diseases do they generally have? The main obstacles to this question include: that studies are performed in different settings (e.g., emergency room, hospital, clinic); they analyze different patient populations (e.g., otolaryngology, neurology, "dizziness specialty" clinic, general medicine); they employ different methods of diagnosis; and they report results in different formats.

Hain [21], like most authorities in the field, approaches the problem with an initial categorization by aetiology: general medical causes, otologic/peripheral causes, neurologic/central causes, and unknown causes. Although this classification is simple, it has the virtue of being broad enough that data from different studies can usually be allocated in such a way as to facilitate comparisons.

Broadly speaking, the terms “otologic” or “peripheral” causes of dizziness refer to those diseases that affect either the vestibulocochlear nerve or its end organ, the labyrinth. The terms “neurologic” or “central” causes of dizziness refer to those diseases that involve the brain, other cranial nerves (besides the vestibulocochlear nerve) or spinal cord. The term “general medical” causes of dizziness refers to diseases affecting other organ systems (besides the cranial nerves and central nervous system).

While this classification scheme is useful, obvious difficulties arise when considering diagnoses that are controversial or fit poorly into any general category. For instance, when a study lists “head trauma” without further specification, should this be considered a “central” cause (perhaps reflecting a post-concussive state), or a “peripheral” cause (perhaps reflecting a fistula, labyrinthine concussion or a traction injury of the vestibular nerve)? Should the controversial entity of cervicogenic vertigo [22, 23] be considered “musculoskeletal” (and therefore “medical”), “central”, or both? While these difficulties raise important questions, the diseases to which they refer generally comprise a relatively small percentage of the cases considered in these studies.

Data from studies citing specific diagnoses are compiled in Table 2.

### 3.1 Diagnoses vary significantly by clinical setting

Comparing data from a variety of studies readily shows that the reported frequencies of particular diagnoses vary considerably depending upon the setting in which patients are evaluated. Emergency rooms, obviously, will tend to see patients presenting with a relatively acute onset of symptoms. General medicine clinics are more likely to see patients with chronic conditions. Otolaryngology clinics are more likely to see disorders presenting with aural symptoms (distortion or loss of hearing, ear pain, tinnitus etc.). “Dizziness specialty” clinics are relatively few in number (despite how common the symptom of dizziness is), and tend to see a fairly broad range of pathology; these clinics often have a multidisciplinary arrangement, and may be staffed by a combination of neuro-otologists (otolaryngologists with particular expertise in otovestibular disorders), oto-neurologists (neurologists with particular expertise in otovestibular disorders), audiologists and physical therapists.

### 3.2 Otolaryngology clinics, adult population

Arya et al. [24] conducted a prospective cohort study of new patients referred to an otolaryngology clinic for “dizziness” and found that 50.6% of patients, after appropriate workup, had a “labyrinthine disorder”. That

article [24] also provides a chart comparing their data with those of other studies. 16% of patients received a diagnosis of “idiopathic”.

Guilemany et al. [25] conducted a prospective study of 591 patients presenting with “vertigo” to an otolaryngology clinic in Barcelona. Ultimately 197 of these patients underwent what was deemed to be an adequate workup. For these patients, the study provided about 20 diagnoses of otologic, neurologic, medical and psychiatric aetiologies. Peripheral causes were found in 34% of patients, with the most common diagnosis being Ménière’s disease in 22%. Central causes were less common, with “cerebrovascular/migraine” figuring prominently at 9%. Medical causes comprised 22% of cases, with musculoskeletal being the most common at 17%. Only 1% of patients remained undiagnosed.

Wells et al. [26] did a retrospective review of 86 patients who presented to several ENT clinics in the UK. Peripheral causes were the most common at 31% of patients, with Ménière’s disease comprising 15% of cases. Central causes comprised only 5% of cases, with migrainous vertigo being the most common at 3%. Ten percent of patients remained undiagnosed.

### 3.3 Otolaryngology clinics, paediatric population

Paediatric otolaryngology clinics report peripheral causes of dizziness in 18.3% [27] to 37.3% [28] of patients, and central causes in 44.4% [27] to 54% [29] of patients.

Of the peripheral causes in children, benign paroxysmal positional vertigo comprises 0.8% [28] to 12% [29] of patients. Strangely, although one study reports benign paroxysmal positional vertigo as the most common peripheral cause of dizziness at 12% [29], another study reports otitis media as the most common at 9.2% [27]. This difference in the most common disorders is difficult to explain.

Of central causes in children, migrainous vertigo accounts for 20.4% [27] to 34% [29] of patients, and this is in fact the most common cause of dizziness overall in the paediatric population. The one study [30] that found a higher percentage of peripheral than central causes in paediatric patients specifically attributed this to a referral bias (“these patients would usually visit other departments firstly”).

From 9.2% [27] to 10% [29] of paediatric cases of dizziness remain undiagnosed.

### 3.4 Dizziness specialty clinics

Bath et al. [31] conducted a prospective study of 812 consecutive patients presenting to a multidisciplinary “dizzy clinic” in Toronto. Of these, 64.7% had a peripheral vestibular cause, 8.1% had a “central” cause, 9.0% were “psychogenic” and 13.3% had a diagnosis of “unknown”.

Table 2. Frequency of specific diagnoses. Numbers for specific diagnoses reflect percentages. Figures in square brackets are calculated based on the data in the source.

Setting	ADULT										PEDIATRIC						
	Otolaryngology					Dizziness specialty clinic					Emergency room		General medicine		Meta-analysis	Otolaryngology	
Source	Arya (2008)	Guillemany (2004)	Wells (1987)	Bath (2000)	Brandt (2004)	Drachman (1972)	Heaton (1999)	Nedzelski (1986)	Neuhäuser (2001)	Herr (1989)	Newman-Toker (2008)	Hanley (2002)	Lawson (1999)	Krenke (2000)	Erbek (2006)	Balatsouras (2006)	Rima (2005)
1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Number of subjects	91	591	86	812	4214	125	400	2515	200	125	9472	72	50	50	54	119	
Peripheral	51	[30.4]	[31]	64.7	[40.9]	38	57.5	[46]	43			[93]	18	[41]	[20]	[18.3]	[37.7]
Otovestibular										32.9							
BPPV	4.06	5	5	18.8	11	4			31			42.2	16	12	7.3	0.8	
Meniere	21.8	15	15	7.4	4				5			10	4	2	1.8	1.7	
"Meniere like conditions"	0.5																
"Labyrinthine hydrops"																	3.3
"Secondary hydrops"			2														
Lermoyez syndrome			1														
Labyrinthitis			3											9			
Sudden deafness	3.04																3.3
Acoustic neuroma	2.03	1															
Labyrinthitis/neuritis	1.01																
Vestibular neuritis			3		7.9				3		40.8				4		11.8
Labyrinthine otosclerosis	1.01																
"Disseminated sclerosis" (presumably otosclerosis)			1														
Eustachian tube dysfunction	0.5																
Cholesteatoma	0.5																1.7
Vestibulopathy																	5
Acute peripheral vestibulopathy, first attack						4											
Acute and recurrent peripheral vestibulopathy						4											
Chronic labyrinthine imbalance						3											
Bilateral vestibular weakness					3.6												
Vestibular paroxysmia					2.7									12			
Peripheral, "Other"					0.5	11											
Perilymphatic fistula																	
Otitis media	2	[13.6]	[5]	8.1	[22.3]	[10]	7.75		[22]			1.5	14	[7]	[54]	[44.4]	[47.6]
Central			3		9.1										34	20.4	14.3
Migrainous vertigo																	
Migrainous vertigo, definite									7							9.2	10.1
Migrainous vertigo, probable									4								
Cerebrovascular/migraine		9.1								4							
Cerebrovascular											4			6			
Brainstem cerebrovascular						5											3.3
"Tension, neck" (cervicogenic)																	0.8
Mal de débarquement																	
Multiple sclerosis						2											
"Visual disorders"						2											

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	"Excessive awareness of normal sensation"						1											
	Arachnoid cyst			1														
	Acute myeloid leukemia			1											1		1.8	
	"Tumor" (central)															12	16.7	19.3
	Benign positional vertigo of childhood															2		
	Amblyopia															6		2.5
	Epilepsy																	
	Neurologic gait disorder							7										0.8
	Chiari I malformation																	0.8
	Ataxia, genetic																	0.8
	"Ophthalmic vertigo"					13.2												
	"Central vestibular syndrome"						4											
	"Neurological, other"		4.5													1		5.5
	Head trauma																	5
Medical		[17]	[22.3]				[5]					[41.5]						
	Cardiac	5	1.01															
	Cardiovascular						4							28				
	Orthostatic syncope		0.5						5									3.3
	Orthostatic hypotension																	
	"Presyncope" (orthostatic hypotension, arrhythmias, other cardiovascular causes)														6			
	Diabetes		1.01															0.8
	"Insulin shock"																	
	Endocrine, nutritional, metabolic						1					11						
	Metabolic															6		
	Renal insufficiency		1.52															
	Respiratory											11.5						
	"Sinusitis-related"																	0.8
	Musculoskeletal	12	17.25									2.8						
	Fibromyalgia		1.01															
	Injury/poisoning											10.6						
	Hematologic											2.1						
	Pregnancy-related											1.7						
	"Neoplasms" (NOS)											0.9						
	Integumentary											0.7						
	"Congenital or recognized in perinatal period"											0.2						
	"Autoimmune thyroiditis, with hypothyreosis"																	0.8
	Mononucleosis																	0.8
	"Viral infections" (presumably systemic)																	27.7
Multifactorial		6	9.6				13	13.5						18				
"Other"		8				13.1			4									
	Costen syndrome		1.01															
	Hyperventilation syndrome						23								4			
Psychiatric			5.07	9	[19.5]	9	11.5	21.1	20				1.5	10	10			5
	Somatiform phobic postural vertigo				16													
	Mental disorders				3.5							7.2						
Undiagnosed or "Idiopathic"		16	1.01	10	13.3	4.2	9	9.75	18.9	7			1.5	22	14	10	9	

Brandt [32] reported on 4,214 patients seen over a 13-year period in a dizziness clinic. A full 40.9% of patients had peripheral vestibular causes, including benign paroxysmal positional vertigo (18.8%), vestibular neuritis (7.9%), Ménière's disease (7.4%), bilateral vestibular weakness (3.6%), and perilymphatic fistula (0.5%). In contrast, 22.3% of patients had a central cause, with 9.1% being migrainous vertigo and 13.2% being other "central vestibular syndromes".

Drachman et al. [33] conducted a prospective study of 125 patients referred to a university outpatient "dizzy clinic" in Chicago. They found 38% of cases to have a peripheral cause, of which benign paroxysmal positional vertigo was the most common at 11%. They found 14% of cases to have central causes, of which the most common was "brainstem cerebrovascular" at 5%. The remaining cases comprised 4% with cardiovascular causes, 9% with psychiatric causes, 13% with multiple causes, 23% with "hyperventilation syndrome" and 9% undiagnosed.

Heaton et al. [34] conducted a prospective study of 400 consecutive patients presenting to a university multidisciplinary neurotology clinic in Toronto. Of these patients, 57.5% had a peripheral vestibular cause, 7.75% had a "central" cause, 11.5% had a "psychogenic" cause, 13.5% had multiple causes and 9.75% were "unknown".

Nedzelski et al. [35] followed 2515 patients over 3113 visits to a "dizziness unit" and concluded that psychogenic dizziness (21.1%) plus "undiagnosed" dizziness (18.9%) were the commonest causes seen.

Neuhauser et al. [36] prospectively studied 200 patients presenting to a "dizziness clinic". They found that 46% of patients had a peripheral vestibular cause of dizziness, consisting mostly of benign paroxysmal positional vertigo (31%), whereas 22% of patients had a central cause of dizziness, including definite migrainous vertigo (7%) or a "neurologic gait disorder" (7%). Of the remaining patients, 5% had orthostatic hypotension and 20% had a psychiatric origin of dizziness.

### 3.5 Emergency rooms

Herr et al. [37] conducted a prospective study on 125 patients presenting to an emergency room. According to diagnoses by emergency physicians, 43% of patients had "some form of a peripheral vestibular disorder".

Newman-Toker et al. [38] reviewed a cross sectional study of emergency room visits from a national survey. The data were selected based on medical diagnosis coding. Out of 9,472 patients presenting to an emergency room with a chief complaint of dizziness, 32.9% had otologic/vestibular causes, 21.1% had cardiovascular causes, 11.5% had respiratory causes, 11.2% had neurologic causes, 11.0% had metabolic causes,

10.6% had injury or poisoning, 7.2% had psychiatric causes, 7.0% had "digestive" causes, 5.1% had genitourinary causes and 2.9% had infectious causes.

### 3.6 General medicine clinics

Lawson et al. [39] conducted a prospective case-control study of fifty consecutive patients age 60 years or older presenting to four general medicine clinics in Newcastle-upon-Tyne. Of these patients, 28% had a cardiovascular cause, 18% had a peripheral vestibular disorder, 14% had a central neurological disorder, 18% had multiple causes and 22% remained undiagnosed.

Hanley et al. [40] recruited 13 general practitioners in Donegal, Ireland and trained them to standardize their clinical evaluation of vertigo. Of 72 patients with dizziness, the average age was 52 years (95% were 53.5 to 60.5 years). The final diagnoses included 42.2% with benign paroxysmal positional vertigo, 40.8% with acute vestibular neuritis, 10% with Ménière's disease, 3% of "vascular origin", 1.5% of "neurologic origin", 1.5% of psychiatric origin, and 1.5% unknown.

## 4. SPECIFIC DIAGNOSES

We will highlight here predominantly the more common diagnoses, and a few of the rare ones.

### 4.1 Peripheral causes in adults

A meta-analysis [41] reported that 41% of all dizziness is of peripheral origin, though individual studies report a very broad range, from as low at 18% [39] to as high as 93% [40]. As mentioned earlier, the figures vary by setting, with otolaryngology clinics reporting a range of 31% [26] to 51% [24], multidisciplinary dizziness specialty clinics reporting 38% [33] to 65% [31], emergency departments reporting 33% [38] to 43% [37], and general medicine clinics reporting a very broad range from 18% [39] to 93% [40].

Benign paroxysmal positional vertigo accounts for only 4.1% [25] to 5% [26] of patients seen in otolaryngology clinics, but anywhere from 11% [33] to 31% [36] of patients evaluated in multidisciplinary dizziness specialty clinics. The reason for the difference between practice settings is unclear, but may have to do with referral bias insofar as patients with benign paroxysmal positional vertigo have no aural symptoms and therefore are less likely to be referred to otolaryngologists. Also notable for this diagnosis is that its cumulative incidence increases dramatically with age [42], with the 1-year prevalence among people 60 years and older being almost 7 times higher than that of people aged 18–39 years. As a consequence, benign paroxysmal



positional vertigo is the most common cause of dizziness overall across the lifespan [42].

Ménière's disease comprises 15% [26] to 21.8% [25] of patients with peripheral vestibular disorders in otolaryngology clinics, but only 4% [33] to 7.4% [32] of those seen in multidisciplinary dizziness specialty clinics. This difference is likely due to referral bias insofar as patients with the aural manifestations of Ménière's disease are likely to be referred to an otolaryngology clinic. A population survey in Japan reported the 1-year incidence of Ménière's disease to be 16 per 100,000 people [43]. However, Harris and Alexander's [44, 45] survey of the literature finds the reported incidence to vary over two orders of magnitude, ranging anywhere from 3.5 to 513 per 100,000 people, and they attribute this range to differences in study methodology and diagnostic criteria.

Vestibular neuritis is listed as comprising anywhere from 3% of patients in an otolaryngology clinic [26] and dizziness clinic [36] to 40.8% of patients in a general medicine clinic [40]. This broad distribution is difficult to interpret. As Neuhauser et al. [46] point out, given how common this disease appears to be, it is rather surprising that it has been tracked in only a single published survey of the general population in Japan [43], which lists a 1-year incidence of 3.5 per 100,000 people.

A generally nonmalignant tumour of the vestibular nerve called a vestibular schwannoma or acoustic neuroma; it is rare, comprising only 1% [26] to 2% [25] of patients. The annual incidence in the general population varies from 1.3 to 4.1 per 100,000 persons, depending on age and gender [47]. Of note, this disease is diagnosed almost exclusively in otolaryngology clinics.

#### 4.2 Peripheral causes in children

The range of reported peripheral causes of dizziness in children is more limited than in adults. The most common causes are benign paroxysmal positional vertigo, which comprises from 0.8% [28] to 12% [29], and otitis media, which comprises 9.2% [27] to 10.1% [28]. Ménière's disease is uncommon in children, comprising only 1.7% [28] to 2% [29].

#### 4.3 Central causes in adults

The finding of central causes of dizziness in adults varies considerably by practice setting, ranging from 2% [24] to 13.6% [25] in otolaryngology clinics, 8.1% [31, 34] to 22% [35, 36] in dizziness specialty clinics, and 1.5% [40] to 14% [39] in general medicine clinics. In otolaryngology clinics, this ranges from "migraine" at 3% [26] to "cerebrovascular/migraine" at 9.1% [25]. Migraine figures more prominently in dizziness specialty clinics at

9% [32] to 13% [36] of patients. It is notable that migrainous vertigo, although not rare [48], generally is diagnosed in otolaryngology clinics and dizziness specialty clinics, not in emergency rooms or general medicine clinics. This is likely due to the fact that this diagnosis is still emerging as a clinical entity [36, 48] and is studied and managed mostly by vestibular specialists, hence its recognition outside of these disciplines is limited.

#### 4.4 Central causes in children

As pointed out earlier, migrainous vertigo accounts for 20.4% [27] to 34% [29] of paediatric patients, and this is in fact the most common cause of dizziness overall in the paediatric population. Though unusual, epilepsy as a central cause of dizziness is reported in 2.5% [28] to 6% [29] of patients in an otolaryngology clinic; this is notable in so far as epilepsy is an extremely rare cause of isolated dizziness in the adult population.

#### 4.5 Medical causes in adults

Diagnosis of medical causes of dizziness varies significantly by practice setting, with dizziness clinics reporting such causes in 5% [33, 36] of patients, otolaryngology clinics in 17% [24] to 22.3% [25] of patients, and an emergency room reporting 41.5% [38] of patients. This range is probably in part due to sampling and referral biases—as patients with acute-onset medical causes of dizziness are likely to be evaluated in an emergency room before they are referred to an otolaryngology clinic or dizziness specialty clinic.

Among medical causes of dizziness, otolaryngology clinics report the most common to be musculoskeletal, ranging from 12% [24] to 17.25% [25] of patients. In contrast, an emergency room reported the most common causes to be "injury/poisoning" (in 10.6% of patients), and respiratory (in 11.5% of patients) [38].

In other practice settings, the most common medical causes of dizziness reported tend to be cardiovascular, including orthostatic hypotension. Dizziness clinics report "cardiovascular" causes in 4% [33] of cases, and orthostatic hypotension in 5% [36] of cases. A general medicine clinic reported 28% [39] of patients to have a "cardiovascular" cause of dizziness. Orthostatic hypotension in itself can be a manifestation of a rather broad array of diagnoses [49], and its prevalence increases with age [50].

#### 4.6 Medical causes in children

Few data are available on this topic. One study reports "metabolic" causes in 6% [29] of patients, while another reports "viral infections" (presumably systemic) in 28% of patients [27].

#### 4.7 Psychiatric causes in adults and children

A psychiatric cause of dizziness in adults was diagnosed in only 1.5% of patients in a general medicine clinic [40]. It is diagnosed slightly more frequently in an otolaryngology clinic at 5.1% [25] and in an emergency room at 7.2% [38]. It is most commonly diagnosed in dizziness clinics, with a frequency ranging from 9% [31, 33] to 21.1% [35].

In the paediatric population, psychiatric causes are diagnosed by otolaryngologists in 5% [28] to 10% [29] of patients.

Some authorities [21] classify psychiatric causes among “unknown” or “undiagnosed” dizziness since it is a diagnosis of exclusion. We hesitate to follow this logic since there are other diseases, such as migrainous vertigo, that are also diagnoses of exclusion.

#### 4.8 Multiple aetiologies

The principle of parsimony (“Occam’s razor”) is generally a broadly applicable heuristic in medicine; nevertheless, the reality in clinical practice is that some patients truly do have more than one cause for a given symptom such as dizziness. “Multifactorial” dizziness is diagnosed in adults in 6% [24] to 9.6% [25] of patients in otolaryngology clinics, in 13% [33] to 13.5% [34] of patients in dizziness specialty clinics, and in 18% [39] of patients in a general medicine clinic.

#### 4.9 Undiagnosed dizziness in adults and children

If one takes “idiopathic” as equivalent to “undiagnosed”, it turns out that a substantial minority of adult patients ultimately receive no diagnosis for their dizziness. In otolaryngology clinics this ranges from 1% [25] to 16% [24], in dizziness clinics from 4.2% [32] to 18.9% [35], and in general medicine clinics from 1.5% [40] to 22% [39]. A meta-analysis concluded that 14% [41] of patients ultimately receive no diagnosis for their symptoms.

In the paediatric population, 9.2% [27] to 10% [29] of patients evaluated in otolaryngology clinics receive no diagnosis.

### 5. CONCLUSIONS

Surveying whole populations is a reasonable method for determining the incidence and prevalence of the symptom of dizziness, but gives little or no information about particular diseases. Generally these studies show that dizziness increases with age. From 5.7% [14] to 8% [15] of people up to age 15 years have experienced dizziness, whereas by age 88–90 years nearly half of all people have dizziness. The one-year prevalence of

dizziness averaged across lifespan is around 21% [3, 4]. Approximately 5% of the population seeks medical care for this symptom.

Information regarding specific diagnoses is usually only available regarding the self-selected population of people who have sought medical attention for their symptoms, so such data have an inherent sampling bias. Bearing this bias in mind, some general observations can be made.

First, the frequency of specific diagnoses differs considerably by practice setting (otolaryngology clinics, dizziness specialty clinics, emergency rooms, general medicine clinics). This, in turn, reflects additional sampling and referral biases.

Second, as in other areas of medicine, the spectrum of pathologies in adults tends to differ from that in children. A meta-analysis [41] suggests that in adults, dizziness is more frequently caused by peripheral vestibular disorders (41%) than by central disorders (8%), with the most common peripheral cause being benign paroxysmal positional vertigo. In children the reverse is true, with peripheral causes accounting for 18.3% [27] to 37.7% [28] of cases of dizziness, and central causes accounting for 44.4% [27] to 54% [29] of cases; the most common central cause (and therefore also the most common cause overall) of dizziness in children is migrainous vertigo.

Third, common diagnoses, such as benign paroxysmal positional vertigo or Ménière’s disease, can be diagnosed in any practice setting. In contrast, rare or controversial diagnoses are, understandably, usually only made in specialized settings. For instance, vestibular schwannomas are generally only diagnosed in otolaryngology clinics [25, 26, 47]; migrainous vertigo is usually only diagnosed in dizziness specialty clinics [36, 48].

Fourth, from 6% [24] to 18% [39] of patients end up having more than one identifiable cause for the symptom of dizziness.

Fifth, anywhere from 1% [25] to 22% [39] of adult patients receive no diagnosis for their symptoms, and 9.2% [27] to 10% [29] of paediatric patients go undiagnosed.

### DEDICATION

This article is dedicated to the dear memory of a warm friend and devoted scientist, Gela Tevzadze (1966–2012).

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