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Epidemiology of migraine

Abstract One-year migraine prevalence rates in the general population for Western countries vary from 4% to 9% in men and from 11% to 25% in women. Non-Western countries report lower figures. Incidence rates for people under 30 years of age vary from 1.5 to 6 per 1000 person-years in men and from 3 to 24 per 1000 person-years in women. Data on the prevalence of migraine in general, on the gender ratio and on the variations in prevalence in the different age ranges are fairly comparable and can be regarded as very close to reality. On the contrary, data on the incidence of migraine, on the prevalence of different migraine subtypes, such as migraine with aura and the so-called migrainous disorder, and on the frequency of migraine attacks show a striking discordance that somewhat undermines their reliability. The main critical

points in prevalence and incidence studies are migraine definition and the methodological approaches used for case screening. Even if International Headache Society (IHS) classification is certainly an improvement over previous tools used in epidemiological studies, the diagnostic criteria for migraine without aura are quite scanty and not easily remembered by subjects belonging to the general population, and those for migraine with aura appear not only difficult to translate for use in a questionnaire or an interview, but also too loose. In particular, the lack of any low-end limit for aura duration may cause an overestimation of migraine with aura prevalence.

Key words Migraine • Migraine without aura • Migraine with aura • Epidemiology • Headache

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In the last decade, there have been many studies on epidemiology of migraine. These studies have dealt not only with those aspects that are strictly related to the spread of the disease, such as prevalence and incidence rates, but also with other interesting aspects, such as familial occurrence, comorbidity and disability.

In this paper, we deal with migraine incidence and above all with migraine prevalence, but we try to go beyond sheer data and percentage figures in order to provide an in-depth analysis that may help to assess their reliability. Indeed, the

availability of reliable data about prevalence is important, not only per se, but also as a starting point to be taken as reference for studies on the risk running in families and on the risk of developing other diseases, as well as studies on the social and economic impact of migraine.

Migraine prevalence studies pose a number of methodological problems: some are typical of all prevalence studies in general, while others are specific to migraine; some of these problems have finally been overcome, while others are still difficult to solve. The main obstacle is case definition.

For a disease like migraine, characterized by the absence of specific biologic markers, one cannot do without precise, well-defined diagnostic clinical criteria. This problem has been partly solved by the International Headache Society (IHS) classification [1], which is definitely a major improvement over previous tools used to classify headaches. Then, there are factors that have long proved to affect the accuracy of prevalence rates, such as the time pattern considered, gender and age.

In Table 1, prevalence rates for migraine are given. Only one-year prevalence studies, i.e. those that have investigated the presence of migraine in the year preceding the study, are considered and males and females are analyzed separately; the age ranges are also indicated. For a more consistent case definition, only post-IHS studies are reported. Prevalence rates for Western countries are fairly consistent, varying from 4.0% to 9.5% in men, and from 11.2% to 25.0% in women [2–12]. Non-Western countries report lower figures [13–19].

Studies on migraine in African and Asian countries generally show lower prevalence rates than do studies in North American and European populations. Even though these differences may be due to methodological considerations, we cannot exclude that cultural and environmental factors play a role. Still unclear is the role, if any, played in migraine prevalence by the sociocultural background and the eco-

nomie status of the subjects studied. Stewart et al. [6] suggested that race-related differences in genetic vulnerability to migraine may also be important. Indeed, migraine prevalence seems to be higher among Caucasians, followed by African Americans and Asian Americans in Baltimore County, Maryland.

As regards sociocultural background, classic medical literature reported a higher prevalence of migraine in subjects with a higher level of education. In 1992 Stewart and Lipton's group reported just the opposite [3], but in 2002 it no longer found any such difference [11]. As to economic status in the American Migraine Study [3], the prevalence of migraine increased as household income decreased, but no such correlation was found in most of the other surveys [4, 20–23] including Lipton et al.'s recent study [11].

In the medical literature there are so far only four studies on migraine incidence. Of these, two are retrospective studies [24, 25] that have clear limitations inherent in recall of age at migraine onset, such as telescoping, failing to report real symptoms, and incorrectly reporting symptoms not actually experienced. These retrospective studies and another study [26] conducted through the linked medical record system show incidence rates that are not much different (for people under 30 years of age, about 1.5–2 per 1000 person-years in men, and about 3–6 per 1000 person-years in women). The only prospective study is that con-

Table 1 One-year prevalence of migraine in the general population for Western and non-Western countries, for studies performed after the 1988 publication of headache classification and diagnostic criteria [1]

Reference	Year	Country	Age, years	Study design	Prevalence, %	
					Men	Women
Western countries						
Rasmussen et al. [2]	1991	Denmark	21–30	Clinical exam and interview	5.9	15.3
Stewart et al. [3]	1992	USA	12–85	Mailed questionnaire	5.7	17.6
O'Brien et al. [4]	1994	Canada	≥18	Telephone interview	7.4	21.9
Van Roijen et al. [5]	1995	Netherlands	≥12	Questionnaire	5.0	12.0
Stewart et al. [6]	1996	USA	18–65	Telephone interview	8.0	19.0
Launer et al. [7]	1999	Netherlands	20–65	Questionnaire	7.5	25.0
Mattson et al. [8]	2000	Sweden	40–74	Personal interview	NR	18.0
Dahlöf et al. [9]	2001	Sweden	18–74	Telephone interview	9.5	16.7
Lipton et al. [10]	2001	USA	≥12	Mailed questionnaire	6.5	18.2
Lipton et al. [11]	2002	USA	18–65	Telephone interview	6.0	17.2
Henry et al. [12]	2002	France	≥15	Personal interview	4.0	11.2
Non-Western countries						
Tekle-Haimanot et al. [13]	1995	Ethiopia	≥20	Questionnaire	1.7	4.2
Wong et al. [14]	1995	Hong Kong	≥15	Telephone interview	0.6	1.5
Alders et al. [15]	1996	Malaysia	≥6	Questionnaire	6.7	11.3
Sakai, Iagarashi [16]	1997	Japan	≥15	Questionnaire	3.6	12.9
Bank, Marton [17]	2000	Hungary	15–80	Questionnaire	4.3	10.7
Zivadinov et al. [18]	2001	Croatia	15–65	Door-to-door interview	12.3	18.0
Kececi, Dener [19]	2002	Turkey	≥7	Personal interview	7.9	17.1

NR, not reported

ducted by Breslau et al. [27] in 1996, which showed markedly higher incidence rates in the same age range (6 per 1000 person-years in men, and 24 per 1000 person-years in women).

It is important to clarify the question as to whether or not the epidemiological data previously mentioned can be considered reliable and, therefore, definitive. In this regard, three elements can be inferred from an analysis of the various prevalence studies. These elements are prevalence of migraine with aura (MA), prevalence of the so-called migrainous disorder, and the frequency of migraine attacks. If we consider them carefully, some doubts arise about the actual reliability of current prevalence data.

Most of the studies on migraine prevalence so far have investigated migraine in general; some have considered MA separately, and a few have investigated migrainous disorder, which the IHS classification [1] describes as a form of headache fulfilling all diagnostic criteria for migraine without aura (MO) but one.

If we analyse post-IHS prevalence studies of MA in the general population, we find that prevalence rates are fairly comparable, varying from 1.2% to 3.7% in men and from 2.6% to 10.8% in women (Table 2) [2, 7–9, 11, 16–19]. However, these percentage figures are definitely, and rather surprisingly, higher than those reported in pre-IHS studies. According to these figures, about one-third of migraineurs suffer from MA. In other words, for every two patients with MO there is one with MA. Rasmussen and Olesen [28] reported that this ratio would even be close to 1:1. These figures are fairly consistent among the different authors, but, frankly, they are quite surprising.

If we proceed to examine the results of studies that considered migraine prevalence rates separately for MO, MA, and the coexistence of MA and MO, we find differences that may even be very marked. Indeed, only 13% of subjects with MA studied by Rasmussen and Olesen [28] versus as

many as 58% of the subjects with MA studied by Lipton et al. [11] also suffered from MO.

To assess how reliable prevalence data on MA can be, it could be useful to evaluate the methods used by authors. Only four [2, 17–19] of the post-IHS studies reported in the literature complied strictly with the IHS diagnostic criteria, while the others [6–8, 11] introduced substantial changes to those criteria with the aim – clearly stated by the authors themselves – of increasing their validity. It is interesting to note, in this regard, what Sakai and Igarashi [16] stated in their report: “Diagnosis of aura based on the IHS criteria was difficult in our questionnaire study because a significant number of answers to the question about aura symptoms were not sufficiently clear to determine whether they were truly indicative of ‘focal cerebral dysfunction’ as defined by the IHS criteria”. For that reason, when they had to analyse the subjects’ answers to the mail questionnaire strictly based on IHS criteria, these authors chose to consider as MA sufferers only those patients whose headache phase had the same characteristics as MO. Too bad that this occurs only in a little over one-third of MA cases, as Mattson et al. [8] showed recently in a Swedish study.

Henry et al.’s findings raise further, more serious, reservations on the validity of IHS criteria for MA in prevalence studies in the general population. Both in their first epidemiological study of the French general population published in 1992 [22] and in a similar study published in 2002 [12], they applied the IHS diagnostic criteria for MO and for MA. Nonetheless, they stated: “No attempt was made to divide cases into those with and those without aura as this differentiation was found by the validation study to be non-reliable because migraine sufferers often cannot distinguish unilateral sensory disturbances from nocturnal acroparesthesia, and scintillating scotoma from photophobia”.

In migrainous disorder there is even greater discordance than in MA [12, 22, 29, 30]. In this disorder, prevalence

Table 2 One-year prevalence of migraine with aura in the general population, for studies performed after the 1988 publication of headache classification and diagnostic criteria [1]

Reference	Year	Country	Age, years	Study design	Prevalence, %		Total
					Men	Women	
Rasmussen et al. [2]	1991	Denmark	21–30	Clinical exam and interview	3.7	5.1	NR
Sakai, Igarashi [16]	1997	Japan	≥15	Questionnaire	1.4	3.6	2.6
Launer et al. [7]	1999	Netherlands	20–65	Questionnaire	NR	NR	5.0
Mattson et al. [8]	2000	Sweden	40–74	Personal interview	NR	3.8	NR
Bank, Marton [17]	2000	Hungary	15–80	Mailed questionnaire	1.2	2.6	2.0
Dahlöf, Linde [9]	2001	Sweden	18–74	Telephone interview	NR	NR	3.4
Zivadinov et al. [18]	2001	Croatia	15–65	Door-to-door interview	3.7	10.8	NR
Kececi, Dener [19]	2002	Turkey	≥7	Personal interview	1.4	3.3	NR
Lipton et al. [11]	2002	USA	18–65	Telephone interview	1.9	5.3	NR

NR, not reported

Table 3 Frequency of migraine attacks in the general population. Values are percentages of subjects experiencing ≥ 1 attack per month

Reference	Year	Country	Frequency, %
Rasmussen et al. [2]	1991	Denmark	16
Henry et al. [22]	1992	France	83
Stewart, Lipton [31]	1994	USA	60
Launer et al. [7]	1999	Netherlands	40
Bank, Marton [17]	2000	Hungary	100
Lipton et al. [10]	2001	USA	62
Dahlöf, Linde [9]	2001	Sweden	60
Zivadinov et al. [18]	2001	Croatia	77
Kececi, Dener [19]	2002	Turkey	90
Lipton et al. [11]	2002	USA	63

rates vary from 16.2% (as reported by Göbel et al. [29] in 1994 in the German population over 18 years of age) to 1.4% (reported by Russell et al. [30] the following year in the Danish population aged 40).

Other differences that can hardly be explained are found in the frequency of migraine attacks (Table 3). These appear to occur once or more than once per month in very few cases in the Danish study [2], in most cases in various USA studies [10, 11, 31], and in all or almost all cases in studies conducted in France [22], Hungary [17] and Turkey [19]. What appears most striking is that there are marked differences also in studies – such as the Danish study [2] compared with the USA studies [10, 11, 31] – that report very comparable migraine prevalence rates.

If we are to understand why there is such striking discordance in the epidemiological data currently available on migraine – a discordance that somewhat undermines their reliability – we should consider the difficulties inherent in the migraine prevalence studies. The critical points are migraine definition and the methodological approaches used for case screening.

As regards migraine definition, the 1988 IHS classification [1] is certainly an improvement over previous tools used in epidemiological studies, but it has nonetheless showed strong limitations. Indeed, diagnostic criteria for MO are quite scanty and are not easily remembered, not so much by patients as by subjects belonging to the general

population who may only sporadically be affected by the disease and may find it difficult to answer questions about the prevalence of the disease in the past year or, worse still, in their lifetime. There must be even more doubts about the reliability of these subjects' recollections when we consider that symptoms may vary from one migraine attack to the next and even within the same attack, and that the same patient may have different headache subtypes.

The IHS diagnostic criteria for MA are not only difficult to translate for use in a questionnaire or an interview, but they are also too loose. Indeed, if these criteria were applied strictly, people who report a few scintillating scotomas or paresthesias lasting as little as a few seconds – the IHS classification does not indicate any low-end limit for aura duration – maybe occurring during the headache phase and not before it – the IHS classification does not exclude this possibility at point 4 – and their headache has no characteristics typical of the migraine form – the IHS classification contains no reference to the characteristics of the headache phase – well, these people would be coded to the group of MA. But, this is wrong from the clinical viewpoint. The resulting risk is that the prevalence of MA may be overestimated in an epidemiological study.

Another major problem that may affect the reliability of prevalence data is the procedure used for case screening, i.e. the tool chosen by investigators (specially designed self-administered questionnaires or semi-structured interviews) and the method of establishing a contact with the study population (mailings, phone calls, face-to-face interviews). A recent meta-analysis by the Lipton group [11] showed that among well-conducted studies of migraine epidemiology, data collection methods did not significantly influence prevalence estimates when standardized diagnostic criteria were used, but, unfortunately, most studies provide insufficient information about the approaches used and the results obtained to validate the instruments utilized in case screening.

In conclusion, we think that, all things considered, data on the prevalence of migraine in general, on the gender ratio and on the variations in prevalence in the different age ranges can be regarded as very close to reality. Much less close to reality may be data on the prevalence of the different migraine subtypes. We hope that, in the future, the efforts of investigators in this field will increasingly be concentrated on identifying methodological procedures with a high degree of reliability.

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