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# Prevalence of chronic migraine and medication overuse headache in Germany—the German DMKG headache study

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A Straube<sup>1</sup>, V Pfaffenrath<sup>2</sup>, K-H Ladwig<sup>3</sup>, C Meisinger<sup>3</sup>,  
W Hoffmann<sup>4</sup>, K Fendrich<sup>4</sup>, M Vennemann<sup>5</sup> and K Berger<sup>5</sup>

## Abstract

Population-based epidemiological studies about the prevalence of chronic migraine using the 2004 International Headache Society (IHS) classification definition are rare. We analysed the data of the Deutsche Migräne und Kopfschmerz Gesellschaft headache study, which included 7417 adults in three regions of Germany, with respect to their headache. Additionally, body mass index, alcohol consumption and smoking behaviour were recorded. Using the IHS definition from 2004, chronic migraine was diagnosed in 0.2% of the population. Half of these patients also fulfilled the criteria of medication overuse headache (MOH). The distribution of migraine attacks per subject was highly skewed, with only 14% of all migraine patients having more than six migraine attacks per month. Patients with chronic migraine or MOH seem more often to be active smokers than controls without headache. A body mass index of  $\geq 30$  was present significantly more often in patients with MOH than in controls or in patients with episodic migraine. The skewed distribution of the numbers of attacks per patient supports the recommendation to differentiate between episodic migraine with low and high attack frequency, as is done in the classification of tension-type headache. It further suggests that migraine with high attack frequency might be biologically different. The higher prevalence of smokers and of patients with a body mass index  $\geq 30$  in chronic migraine or MOH supports the idea of a frontal dysfunction in these patients.

## Keywords

6-month prevalence, chronic migraine, medication overuse headache, body mass index, smoking, drinking

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## Introduction

The 2nd classification of headaches (2004) of the International Headache Society (IHS) included chronic migraine as 1.5.1 under complications of migraine (1). The prevalence of chronic migraine is still under discussion, for several reasons: (i) there are only a limited number of population-based epidemiological studies that include chronic migraine in their assessment; and (ii) there is still debate about how to differentiate chronic migraine from medication overuse headache (MOH), since patients with daily or near-daily headache often report an intake of pain medication every day. Thus, it can be difficult to decide if this regular use of pain medication is the cause or the result of the increased headache frequency. A consequence of this discussion was that the IHS recently published

appendix criteria for chronic migraine (see comparison of both criteria in (2,3)). In these criteria, headache still had to be present on  $\geq 15$  days/month; however,

<sup>1</sup>Department of Neurology, Klinikum Großhadern Ludwig-Maximilians-University Munich, Germany.

<sup>2</sup>Neurology Practice, Munich, Germany.

<sup>3</sup>Institute of Epidemiology, Helmholtz Zentrum München, German Research Centre for Environmental Health (GmbH), Neuherberg, Germany.

<sup>4</sup>Institute for Community Medicine, University of Greifswald, Greifswald, Germany.

<sup>5</sup>Institute of Epidemiology and Social Medicine, University of Münster, Münster, Germany.

### Corresponding author:

Andreas Straube MD, Department of Neurology, University of Munich, Klinikum Grosshadern, 81377 Munich, Germany.

Email: astraube@nefo.med.uni-muenchen.de

migraine headache is required on only  $\geq 8$  days. In addition, migraine headache is defined as a headache that responds to specific migraine therapy. This definition reflects the fact that in patients with chronic migraine the characteristics of the headache change and that vegetative symptoms as well as the pulsating character of the headache are less frequent than in the former episodic migraine of these patients.

In a review of the global burden of headache the authors estimate that about 3% of the population worldwide suffers from chronic daily headache (4). In a small epidemiological study in Brazil the 1-year prevalence of chronic daily headache was 6.4%, and roughly 80% of these patients were classified as having chronic migraine (5). Risk factors for developing a chronic headache were the regular use of analgesics (6), female gender, low income and divorce or widowed marital status (7). Another study found that obesity is a further risk factor for developing a chronic migraine (8). In contrast to these few epidemiological studies on chronic migraine, it is known from clinical management that patients with chronic migraine are those with the greatest need for care. A recent French survey showed that patients with chronic migraine used the healthcare system more frequently, i.e. more active consultations, than patients with episodic migraine (9).

The aim of the present study was to estimate the prevalence of chronic migraine, MOH and combinations of both in the large population-based German Deutsche Migräne und Kopfschmerz Gesellschaft (DMKG) Headache Study (10,11).

## Methods

The study design and methods were described in detail in previously published reports (10,11). In brief, based on two population studies in Germany, the Study of Health in Pomerania in the north-east and the KORA 3 Survey (Cooperative Health Research in the Region of Augsburg) in the south of Germany and a new survey in the city of Dortmund in the west of Germany, it was possible to perform standardized headache assessments in 7417 adults from these three German regions. Pomerania is a rural area on the Baltic Sea, the region of Augsburg is characterized by a mixed rural and urban population and Dortmund is an example of a typical urban population with the problems of a large city.

In all three study regions participants were interviewed face-to-face by trained interviewers. The standardized interview included questions on socio-demographic data, the utilization of healthcare services during the last 12 months and all medication intake in the last 7 days including prescribed and over-the-counter medications. A standardized headache

question module with 14 single items designed to assess the new (2004) classification of the IHS was used in all interviews. This questionnaire allowed the classification of migraine and tension-type headache (TTH), especially the classification of the episodic form of migraine (IHS code 1.1 and 1.2), of 'chronic' migraine (IHS code 1.5), as well as MOH (IHS 8.1). We determined the prevalence of chronic migraine including and excluding patients with concurrent medication overuse. MOH was classified based on the symptom frequency and the frequency of medication intake specifically for headache during the last month. Thus, we assumed that the frequencies during the last month are the same as during the last 3-month period. The headache questionnaire was validated against headache specialist ratings in a sample of 95 participants of the Dortmund Health Study, conducting additional clinical interviews on eight randomly chosen days. Agreement between the two classifications was found to be good. ( $\kappa$  statistics were calculated. They ranged from 57% indicating well to satisfactory inter-rater agreement for TTH, to a  $\kappa$  of 94.5% for MOH indicating excellent agreement).

The headache question module was used in all three regions and allowed a headache classification based on the 6-month prevalence of headache (10,11). In the Dortmund survey the module was extended with additional questions on the time frame of symptoms in order to assess 12-month headache prevalences. In addition, the frequency of cardiovascular risk factors and disorders and other comorbidities was recorded. Written informed consent was obtained from the participants in all three study regions and the study protocols were approved by the local ethics committees.

## Statistical analysis

We report simple prevalence of headache types, stratified by region. The prevalence of vascular risk factors according to headache type was analysed using  $\chi^2$  test (12). STATA, version 9.0, was used in all analyses (StataCorp LP, College Station, TX, USA).

## Results

The prevalence and absolute number of individuals with migraine (complete criteria), MOH and chronic migraine (two definitions) for the three examined regions are shown in Table 1.

The IHS criteria for MOH were fulfilled in 73 patients in the pooled data, not taking potential features of chronic migraine into account, thus patients fulfilling the criteria for both are included in this number. This yielded a prevalence of about 1.0% across the regions. Of the MOH patients, 74% were

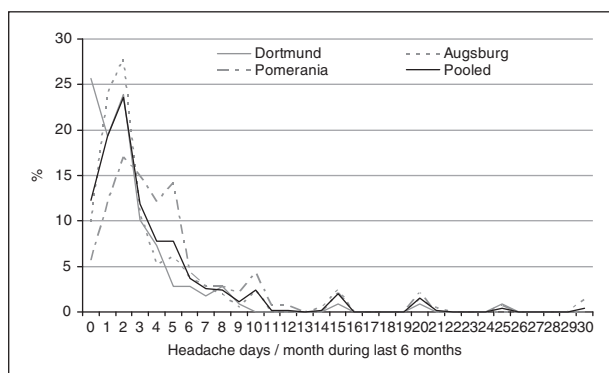
**Table 1.** Six-months prevalences of migraine, medication overuse headache and two definitions of chronic migraine, according to study region

Headache type	Dortmund health study		KORA Augsburg	SHIP Pomerania		Total
	35–75 years <i>n</i> = 1134	(25–75 years) ( <i>n</i> = 1312)	35–75 years <i>n</i> = 2805	35–75 years <i>n</i> = 2597	(25–88 years) ( <i>n</i> = 3300)	35–75 years <i>n</i> = 6536
Migraine, %	8.00	(8.46)	7.91	4.39	(4.31)	6.53
Medication overuse, % headache	0.88	(0.91)	0.96	1.04	(1.03)	0.98
Chronic migraine A*, %	0.09	(0.23)	0.32	0.23	(0.27)	0.28
Chronic migraine B†, %	0.00	(0.00)	0.14	0.08	(0.09)	0.09

\*Complete criteria for chronic migraine are fulfilled including individuals also fulfilling medication overuse headache (MOH) criteria.

†Complete criteria for chronic migraine are fulfilled excluding individuals also fulfilling MOH criteria.

SHIP, Study of Health in Pomerania.



**Figure 1.** Distribution of the individual headache frequency (days per month) in the three different regions and the pooled data.

women. For the Dortmund region we also calculated the prevalence of MOH using a cut-off of  $\geq 10$  days of headache and medication use on  $\geq 10$  days. This yielded a prevalence of 1.37% ( $n=18$ , 10 being women) compared with 0.91% ( $n=12$ , nine being women) with the standard definition of  $\geq 15$  days.

Only 0.28% of the investigated individuals fulfilled the 2004 IHS classification criteria for chronic migraine, not taking concurrent medication overuse into account. The vast majority of this group (87%) was women. The mean number of headache days in these patients was 19/month. In order to analyse the distribution of patients with migraine we plotted headache day frequencies (Fig. 1). In all three regions headache days per month showed a highly skewed distribution, with 13.6% of all patients with migraine having more than six headache days per month. In contrast, 31.6% of these patients reported only 1 day or less of headache per month. Figure 1 depicts the distribution of headache days per month among all patients with migraine in the pooled dataset and by region. It is obvious that the distribution is not Gaussian. The median number of headache days was 4 days.

We also analysed the prevalence of ‘pure’ chronic migraine. Thus, we applied the strict IHS-2 criteria that categorize individuals who fulfil both headache type criteria into MOH. We could then describe how often patients with chronic migraine also have medication overuse. From the total of 21 patients across all age groups in the three studies who fulfilled the IHS criteria for chronic migraine, 14 (66.7%) also fulfilled the criteria for MOH. Thus 1.47% of all migraine patients and 0.09% of the adult population in this study seem to have ‘pure’ chronic migraine. If we restricted this analysis to the age range 35–75 years, which was comparable across the studies, we observed 16 patients with chronic migraine of whom 10 (62.5%) had medication overuse, yielding 1.41% of all migraine patients and also 0.09 of the population in this age range.

Finally, we analysed components of health behaviour, such as smoking and drinking, in patients with episodic migraine, chronic migraine according to both definitions, those with MOH and individuals without headache for comparison reasons in all three regions. Tables 2, 3 and 4 report these results. Compared with individuals without headache and those with episodic migraine, patients with MOH had lower alcohol consumption. In contrast, there were more active smokers in this group and a higher proportion of obese individuals compared with the other groups. Cardiovascular comorbidities (histories of diabetes or myocardial infarction, hypertension) were more frequent in the group with MOH.

## Discussion

The question of the prevalence of chronic migraine and MOH is important, since these subgroups are the patients who most often seek medical help and thus have the highest impact on the healthcare system (9). Using the criteria of the 2nd IHS classification and

**Table 2.** Health-related behaviours and comorbidities of patients with medication overuse headache (MOH) and chronic migraine in the Dortmund Health Study (age group 35–75 years)

		Controls No headache	Episodic migraine	Chronic migraine A <sup>1</sup>	Chronic migraine B <sup>2</sup>	MOH
		<i>n</i> = 620	<i>n</i> = 89	<i>n</i> = 1	<i>n</i> = 0	<i>n</i> = 10
Mean age (years)		59.1	47.5	64.0	–	53.2
Women, <i>n</i> (%)		368 (42.2)	70 (78.7)	1 (100)	–	8 (80.0)
Alcohol, g/day	men	16.9	14.3	–	–	11.4
	women	7.2	6.8	5.7	–	2.9
Active smoker, %		21.8	25.8	0.0	–	40.0
Mean BMI, kg/m <sup>2</sup>		28.2	26.8	27.3	–	31.4
Obese (BMI ≥ 30), %		29.1	24.7	0.0	–	60.0
History of diabetes, %		10.2	6.7	0.0	–	10.0
History of hypertension, %		40.7	25.8	100.0	–	50.0
History of myocardial infarction, %		5.2	1.1	0.0	–	0.0
History of cancer, %		5.5	5.7	0.0	–	0.0

A<sup>1</sup>, Complete criteria for chronic migraine are fulfilled including individuals also fulfilling MOH criteria.

B<sup>2</sup>, Complete criteria for chronic migraine are fulfilled excluding individuals also fulfilling MOH criteria.

BMI, body mass index.

**Table 3.** Health-related behaviours and comorbidities of patients with medication overuse headache (MOH) and chronic migraine in the KORA Augsburg Study (age group 35–75 years)

		Controls No headache	Episodic migraine	Chronic migraine A <sup>1</sup>	Chronic migraine B <sup>2</sup>	MOH
		<i>n</i> = 1275	<i>n</i> = 203	<i>n</i> = 9	<i>n</i> = 4	<i>n</i> = 27
Mean age (years)		57.2	50.0	52.7	60.8	53.2
Women, <i>n</i> (%)		528 (41.4)	171 (84.2)	8 (88.9)	4 (100.0)	20 (74.1)
Alcohol, g/day	men	25.6	17.4	0	–	6.1
	women	8.9	6.5	1.8	1.3	8.0
Active smoker, %		17.2	19.2	33.3	0.0	44.4
Mean BMI, kg/m <sup>2</sup>		27.9	26.6	27.0	28.6	28.6
Obese (BMI ≥ 30), %		26.1	20.2	22.2	25.0	33.3
History of diabetes, %		8.6	3.9	0.0	0.0	7.4
History of hypertension, %		52.4	36.0	55.6	75.0	48.2
History of myocardial infarction, %		2.0	1.0	0.0	0.0	7.4
History of cancer, %		5.8	3.9	33.3	50.0	7.4

A<sup>1</sup>, Complete criteria for chronic migraine are fulfilled including individuals also fulfilling MOH criteria.

B<sup>2</sup>, Complete criteria for chronic migraine are fulfilled excluding individuals also fulfilling MOH criteria.

BMI, body mass index.

including and excluding patients with medication overuse from the group with chronic migraine, we found that only 0.28% (MOH included) and 0.09% (MOH excluded), respectively, of the study participants were categorized as having chronic migraine in our population-based study.

Several epidemiological studies have reported on chronic headache before. In a Spanish population-based study 4.7% had chronic headache (13), 2.4% of

whom had a transformed migraine, using the criteria published by Silberstein et al. (14). At the same time an American study found frequent headache (> 180 days/year) in 4.1% of the population, whereby Whites were more often affected than African-Americans (15). About one-third of these patients demonstrated migrainous features, corresponding to 1.4% of the population. The HUNT study found chronic headache in 1.5% of the investigated Norwegians, with about

**Table 4.** Health-related behaviours and comorbidities of patients with medication overuse headache (MOH) and chronic migraine in the SHIP Study (age groups 35–75 years)

	Controls No headache <i>n</i> = 1427	Episodic migraine <i>n</i> = 111	Chronic migraine A <sup>1</sup> <i>n</i> = 6	Chronic migraine B <sup>2</sup> <i>n</i> = 2	MOH <i>n</i> = 27
Mean age, years	57.6	50.1	56.3	61.0	53.6
Women, <i>n</i> (%)	592 (41.5)	95 (85.6)	5 (83.3)	2 (100)	19 (70.4)
Alcohol, g/day					
men	16.7	9.9	7.6	–	5.6
women	4.7	4.1	1.2	0.7	3.3
Active smoker, %	24.0	24.3	33.3	0.0	29.6
Mean BMI, kg/m <sup>2</sup>	28.5	27.3	30.6	31.1	28.7
Obese (BMI ≥ 30), %	34.3	27.9	66.7	100.0	37.0
History of diabetes, %	12.6	3.6	0.0	0.0	14.8
History of hypertension, %	54.2	45.1	50.0	100.0	40.7
History of myocardial infarction, %	4.8	2.7	16.7	50.0	7.4
History of cancer, %	6.6	4.5	16.7	50.0	11.1

A<sup>1</sup>, Complete criteria for chronic migraine are fulfilled including individuals also fulfilling MOH criteria.

B<sup>2</sup>, Complete criteria for chronic migraine are fulfilled excluding individuals also fulfilling MOH criteria.

BMI, body mass index; SHIP, Study of Health in Pomerania.

one-third expressing features of migraine (0.5% of the population) (16), probably representing a transformed or chronic migraine. In a review of epidemiological headache studies in Europe, Stover et al. calculated that the 1-year prevalence of chronic headache is about 4% (17). In summary, these studies report quite different prevalences for chronic headache with migrainous features ranging from 0.5% to 2.4%. The reason for this variation is not completely clear. Probably, different definitions of transformed migraine or chronic migraine were used and the broad overlap between chronic migraine and MOH was not taken into account (14,18). In our study we used the definitions of the 2004 IHS classification (1) only, relaxing the item of medication overuse to be included and excluded. By doing this we were able to show that roughly 60% of chronic migraine patients also had medication overuse. Thus, we could quantify the ‘overlap’ to be about 60% between MOH and chronic migraine, whereby in an actual patient it is often difficult to differentiate if the medication use is the consequence of or the reason for the frequent headaches. Concordant with the other studies, we found a strong preponderance of women among the affected subjects.

We observed a highly skewed distribution of headache days in the population of migraineurs, with 86% of them having fewer than seven headache days per month. Studies investigating the distribution of migraine days are rare. In an Austrian survey 22.4% of patients had a frequency of one or more attacks per week (19). In an Italian survey that investigated the prevalence of migraine in patients visiting their general

practitioners, roughly 75% of patients had one to three attacks or fewer per month, and 25% one to seven attacks per week (20). These results are in good agreement with our own. From these data it can be concluded that a skewed distribution of the migraine attack frequency is a general phenomenon in patients suffering from migraine and might reflect different risks for chronification of an existing migraine. Future prospective studies have to show if this skewed distribution is the result of a small subgroup that directly, *de novo*, develops a frequent migraine, or if it is the result of an individual chronification process.

An important methodological question is if the cut-off of ≥ 15 migraine days per month reflects biology or is an arbitrary setting by the IHS Classification Committee. The assumption of biological differences between episodic and chronic migraine patients is supported by findings that chronic migraine patients present with more comorbid disorders, a finding that is supported by our data from three German regions. Chronic migraine patients also perform more polypharmacy, and have other social impediments than episodic migraine patients (21). Another point of discussion is if the IHS classification should be expanded to include the diagnosis ‘frequent migraine’, as in TTH, in order to reflect such a process.

We were able to analyse health-related behaviours of the migraine patients in our study regions. Daily alcohol consumption was lower in all headache type groups than in controls, which may be explained by the experience of patients of triggering migraine attacks through alcohol. We found a higher percentage of

active smokers in the group with MOH. This finding is in agreement with the idea of disturbed fronto-striatal neuronal loops in patients with this headache type. Recent publications have reported that some patients with MOH also show signs of addictive behaviour (21,22) and discuss an involvement of the fronto-striatal system (23), as suggested by findings of a persisting hypoactivation of the orbito-frontal cortex in functional magnetic resonance imaging of patients with MOH (24). As observed in other studies (25), we also found a clear increase of average body mass index and in the percentage of obese patients in the MOH group. We interpret this as a further indication of disturbed fronto-striatal loops, since other studies have indicated frontal cortex involvement in obesity (26,27).

Our study has strengths and limitations. We were able to address several methodological aspects relevant to the application of the IHS criteria. We used identical case classification and face-to-face interviews for all participants. Participants in all three study populations were initially randomly drawn from regional or community registries. We applied the new IHS criteria for headache classification, especially the definition of chronic migraine. Among the limitations is the fact that we based the classification of MOH on a headache frequency in the last month using this as a proxy for the last 3-month period. This might have slightly overestimated the MOH prevalence in case individuals had lower frequencies in the 2 months prior to the one assessed. However, the number of MOH and chronic migraine cases in our study is small, despite the large sample size.

In summary, using the 2004 definition of the IHS, we found a lower prevalence of chronic migraine than in previous studies. Furthermore, we were also able to show that the number of migraine days in the group of migraine sufferers is not equally distributed but highly skewed. This may indicate that frequent migraine is biologically different from low frequent episodic migraine. The analyses of health-related behaviour, especially alcohol consumption, smoking and obesity, in patients with MOH support the hypothesis of a dysfunction of fronto-striatal neuronal circuits in these patients.

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