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Prevalence of primary headache disorders diagnosed according to ICHD-3 beta in three different social groups

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Abstract

Background: The aim of our study was to estimate the one-year prevalence of primary headache disorders in three different social groups using the third edition beta of the International Classification of Headache Disorders (ICHD-3 beta).

Material and methods: The study population included a total of 3124 participants: 1042 students (719 females, 323 males, mean age 20.6, age range 17–40), 1075 workers (146 females, 929 males, mean age 40.4, age range 21–67) and 1007 blood donors (484 females, 523 males, mean age 34.1, age range 18–64). We used a semi-structured, validated face-to-face interview.

Results: The age-adjusted one-year prevalence of migraine in females was significantly higher ($p < 0.001$) in students (41.9%) than in workers (19.2%) and blood donors (18.7%). Age-adjusted prevalence of migraine among males did not differ among the three groups: 4.5% in students, 4.9% in workers and 4.5% in blood donors. Age-adjusted prevalence of tension-type headache (TTH) among females was almost the same in students and blood donors (68.8% and 66.7%) but female workers had a lower prevalence of TTH (57%). Age-adjusted prevalence of TTH among males did not differ significantly between students and blood donors (55.8% and 58.1%) but male workers had a significantly lower ($p < 0.001$) prevalence of TTH (30.7%). The prevalence of chronic headache in students (TTH and/or migraine) was 3% and of probable medication-overuse headache 3%, significantly more than in workers and blood donors.

Conclusion: Headache prevalence was high and differed markedly among the three social groups. It is important that headache epidemiology also focus on socially defined groups in order to target future preventive efforts.

Keywords

Migraine, tension-type headache, prevalence, epidemiology, Russia, social group

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Introduction

Lots of studies in many different countries have examined the prevalence of headache disorders (1–9). None of them have, however, used the newly published International Classification of Headache Disorders third edition beta (ICHD-3 beta) to diagnose the different types of headache (10). Furthermore, only a few studies have previously compared the prevalence of headache disorders in different social groups including sufficiently large samples in each social group to allow precise comparisons (11–17).

Our two hypotheses were that the results using ICHD-3 beta would be similar to results with ICHD-2 and that the prevalence of headache disorders would

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differ among social groups. We therefore conducted a professional direct interview using a validated semi-structured questionnaire in three different social groups: students, workers and blood donors. This diagnostic methodology is optimal for epidemiological studies but it is very resource demanding. Nevertheless, we included more than 1000 people in each group to allow sufficient statistical strength to document differences between groups, and we used ICHD-3 beta diagnoses for the first time in a large epidemiological study. We performed age- and sex-specific analyses of the data.

Materials and methods

Study design

This was a cross-sectional study that was conducted between September 2012 and August 2013.

Study populations

We included 3124 individuals who agreed to be interviewed and were able to give characteristics of headaches unless the following reasons for exclusion were present: patient had a history of stroke or transient ischemic attack (TIA), subarachnoid hemorrhage, intracranial aneurysm, intracranial hemorrhage, brain tumor, any operation on the brain, multiple sclerosis, epilepsy, encephalitis, meningitis, dementia, or other serious neurological or somatic disorder. Selection of the three social groups that were needed to test our hypotheses was based on feasibility. We had already used blood donors as controls in previous studies of saccular intracranial aneurysms and knew that they would have a high participation rate. Although they come from many different occupations, they still constitute a social group. This is defined as "two or more people who interact with one another, share similar characteristics and collectively have a sense of unity" or "a group is defined in terms of those who identify themselves as members of the group" (18). Workers could be studied as part of a compulsory health examination conducted by one of the authors that also ensured a high participation rate. Finally, we already had contact with medical students with an interest in headache, and discussion with class representatives indicated that also here we could have a high participation rate.

Data collection

All participants were interviewed using a semi-structured, validated face-to-face interview conducted by a neurologist or by trained senior medical students. The student interviewers were recruited after a postgraduate lecture on headache attended by especially interested medical students. Fifteen senior (last year of medical university) medical students accepted but only 11 completed the following program and completed the actual interviews. First they were given literature and personal teaching. Next they performed at least 10 supervised interviews that were not used in the actual study. The participation rate for students was 92%. We performed this interview in their classrooms when all lessons were finished at the end of the day. We included students at all semesters (1–12).

Workers at an oil and gas factory were recruited as part of a compulsory annual medical examination of all employees. Office workers were not included. Participation was 97%. The interview was performed in the room where a neurologist examined these workers during the annual medical examination. In some cases time did not allow us to finish the headache interview immediately but participants agreed to finish the interview by telephone.

Blood donors were recruited consecutively in association with their donation of blood. We included everybody who agreed to participate and met inclusion and exclusion criteria. Participation was 98%. The interview was performed in the room where donors donated their blood. Because of the high participation rate in all three groups, it was judged unnecessary to perform a non-participant analysis.

The semi-structured interview was modified and expanded from a previously validated interview (19). It included four parts: 1) personal data (age, sex, profession, telephone number); 2) detailed characteristics of headache; 3) information about possible risk factors for headache, and 4) previous consultation, diagnosis and treatment of headache. The latter two data sets will be published separately.

Our diagnostic procedure included three steps. The semi-structured face-to-face interview about headache in the previous year was first obtained from all three groups. Repeated interview by telephone was then performed by a neurologist (NRK) if participants had incomplete data for ICHD-3 beta diagnosis or if other important information was missing. We re-interviewed 2% of the participants. The headaches of each participant were then diagnosed according to ICHD-3 beta by ERL, NRK and JO. We did not include questionnaires if important data were missing and it was impossible to contact the participant. We excluded on this basis 125 participants and also excluded five participants according to our exclusion criteria. The total number of participants included in the study was 3124.

Statistical analysis

The outcome variables of the study were the crude and gender-standardized one-year prevalence of migraine

Table 1. Age and sex distribution of participants of three different social groups (blood donors, workers and students).

Characteristics	Blood donors (n = 1007)	Workers (n = 1075)	Students (n = 1042)	All (n = 3124)
Male	523 (52%)	929 (86%)	323 (31%)	1775 (57%)
Mean age	33.0	39.8	20.9	31.2
Age range	19–61	21–67	17–38	17–67
Female	484 (48%)	146 (14%)	719 (69%)	1349 (43%)
Mean age	35.6	43.2	20.5	33.1
Age range	18–64	25–62	17–40	17–64
All	1007	1075	1042	3124
Mean age	34.1	40.4	20.6	31.7
Age range	18–64	21–67	17–40	17–67

without aura and with aura, probable migraine (all but one International Headache Society (IHS) criterion met, and not fulfilling the IHS criteria for TTH), episodic/frequent TTH, probable TTH (all but one IHS criterion for TTH met and not fulfilling the IHS criteria for migraine or probable migraine), cluster headache, chronic probable migraine, chronic TTH and probable medication-overuse headache. No participant overused triptans or other migraine drugs except analgesics (painkillers).

Age-specific prevalence of primary headache disorders in the three groups was calculated using the direct standardization method (20). The age structure of the total sample (donors, workers and students) was used as a standard. The sex-specific differences in headache non-adjusted prevalence among participants of the three different social groups were statistically examined by an unpaired t-test and chi-square test. Crude prevalence of headache disorders was calculated in percentages. Odds ratios (OR) and 95% confidence intervals (CI) were estimated using univariate and multiple conditional logistic regression models. We aimed to have power to detect differences between social groups in prevalence of migraine and TTH but not their subforms or differences in the prevalence of the rarer headache disorders. A two-tailed p-value < 0.05 was statistically significant.

We estimated that the average prevalence of migraine would be 12% (2,9) and that it would be 16% in females and 8% in males. With a p value of 0.05 and a risk of type 2 error of 20%, we estimated that the sample size would need to be 258. In order to have power to detect sex-specific differences and to have enough power if differences were somewhat smaller, we chose a sample size of 1000. For each item we used only participants with data on that item. Therefore the number of participants in these tables was sometimes less than the total number in each group.

Ethics considerations

The Medical Ethics Committee of the Urals State Medical University approved this study. All respondents were informed of the purpose of the survey. Written informed consent was obtained from all participants.

Results

We included 3124 participants (1349 females), mean age 31.7, range 17–67 (Table 1). They consisted of: 1042 students (719 females) mean age 20.6, range 17–40, 1075 workers (146 females) mean age 40.4, range 21–67, 1007 blood donors (484 females), mean age 34.1, range 18–64. Most students lived in Yekaterinburg, 7% lived in cities of the Sverdlovsk region, 0.5% in other Russian cities and very few in villages. All participants from Surgut were skilled manual workers and 982 (91.3%) lived in Surgut while 93 (8.7%) were males living away from home. Most blood donors lived in Yekaterinburg, only few (2%) in cities around Yekaterinburg. They included people from different professions and represented people from the general population. Most participants in all three social groups were in medium social strata and very few (1.1%) had low social status, all in the group of blood donors.

Females predominated in the group of students (69%), males in the group of workers (86%) and donors had almost equal sex distribution (48% females). Students were youngest, workers oldest and blood donors intermediate (Table 1). The one-year prevalence of headache in the total cohort was 67.5% (Table 2). Migraine including probable migraine 15.9% (without aura 13.5%, with aura 2.4%), episodic TTH 57.3%, chronic headache 1.7%, medication-overuse headache 1.4%, and cluster headache 0.03% (Table 3). Some participants had more than one headache diagnosis: 2110 participants had 2442 headache diagnoses, mean 1.1 per person. Each type of headache was classified separately. Most participants with more than one type of headache had a combination of migraine and TTH. Females prevailed among

Table 2. One-year crude prevalence of headache disorders according to ICHD-3 beta in blood donors, workers and students.

Diagnosis[a]	Male (n = 1775)			Female (n = 1349)			All (n = 3124)			
	Donors (n = 523)	Workers (n = 929)	Students (n = 323)	Donors (n = 484)	Workers (n = 146)	Students (n = 719)	Donors (n = 1007)	Workers (n = 1075)	Students (n = 1042)	All (n = 3124)
Migraine without aura	19 (3.6%)	41 (4.4%)	45 (13.9%)	74 (15.3%)	24 (16.4%)	202 (28.1%)	93 (9.2%)	65 (6.0%)	247 (23.7%)	405 (12.9%)
Migraine with aura	4 (0.7%)	10 (1.1%)	2 (0.62%)	17 (3.5%)	3 (2%)	38 (5.3%)	21 (2.1%)	13 (1.2%)	40 (3.8%)	74 (2.4%)
Chronic probable migraine	1 (0.2%)	0 (0%)	0 (0%)	3 (0.6%)	0 (0%)	1 (0.1%)	4 (0.4%)	0 (0%)	1 (0.1%)	5 (0.2%)
Probable migraine	1 (0.2%)	1 (0.1%)	1 (0.3%)	0 (0%)	0 (0%)	9 (1.2%)	1 (0.1%)	1 (0.1%)	10 (0.9%)	12 (0.4%)
Episodic TTH	307 (58.7%)	301 (32.4%)	250 (77.4%)	311 (64.3%)	94 (64.4%)	526 (73.2%)	618 (61.4%)	395 (36.7%)	776 (74.5%)	1789 (57.3%)
Chronic TTH	4 (0.8%)	1 (0.1%)	6 (1.9%)	7 (1.4%)	2 (1.4%)	26 (3.6%)	11 (1.1%)	3 (0.3%)	32 (3.1%)	46 (1.5%)
Cluster headache	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (0.1%)	0 (0%)	0 (0%)	1 (0.1%)	1 (0.03%)
Medication-overuse headache (analgesics)	0 (0%)	4 (0.4%)	6 (1.9%)	8 (1.6%)	0 (0%)	26 (3.6%)	8 (0.8%)	4 (0.4%)	32 (3.1%)	44 (1.4%)

[a]Diagnoses are not mutually exclusive.
TTH: tension-type headache; ICHD-3 beta: third edition beta of the International Classification of Headache Disorders.

participants with any type of headache in all groups; one-year prevalence of any headache was 85.0% in females and 54.2% in males.

The prevalence of any headache varied among social groups (Table 2): In females it was 95.1% in students, 69.2% in workers, 74.5% in blood donors ($p < 0.001$); in males it was 87.9% in students, 38.3% in workers and 61.7% in donors ($p < 0.001$). The migraine prevalence was 15.9% overall. In females it was: 34.7% in students, 18.5% in workers and 19.4% in blood donors ($p < 0.001$); in males: 14.8% in students, in 5.6% workers, and 4.8% in blood donors ($p < 0.001$) (Figure 1(a) and (b)). The prevalence of TTH in females was: 76.7% in students, 65.7% in workers and 67.5% in blood donors ($p > 0.05$); in males: 79.2% in students, 32.5% in workers, and 59.5% in blood donors ($p < 0.001$). We found that 51 participants (1.6%) out of 3124 had chronic headache. Five participants had chronic probable migraine (four females and one male); blood donors (0.4%) and students (0.1%) and no workers had chronic migraine. The prevalence of chronic TTH in students (3%) was higher than in donors (1%) and workers (0.3%), $p < 0.0001$, and it was significantly higher in females (3.6% in students, 1.4% in blood donors and 1.4% in workers) than in males (1.9% in students, 0.8% in blood donors and 0.1% in workers). Probable medication-overuse headache (analgesics ≥ 15 days per month) in students (3%) was higher than in blood donors (0.79%) and workers (0.37%), $p < 0.001$.

Figure 1(a) shows crude headache prevalence (migraine and TTH) in percentage of males in three different social groups (blood donors, workers, students), and Figure 1(b) shows distribution of crude headache prevalence in females in three different social groups.

The age-adjusted prevalence of primary headache disorders in three social groups did not deviate substantially from the non-adjusted values presented above. Students had the highest prevalence of migraine 28.6% (workers 5.7%, blood donors 11.7%) (Table 3). Students also had the highest prevalence of TTH 67.1% (workers 31.9%, blood donors 60.2%) (Table 4). Age-adjusted prevalence of migraine among females was significantly higher in students (41.9%) than in workers (19.2%) and blood donors (18.7%). Age-adjusted prevalence of migraine among males did not differ among the three groups: 4.5% in students, 4.9% in workers and 4.5% in blood donors. Age-adjusted prevalence of TTH among females was almost the same in students and blood donors (68.8% and 66.7%) but female workers had a lower prevalence of TTH (57%). Age-adjusted prevalence of TTH among males did not differ significantly between students and blood donors (55.8% and 58.1%) but male

Table 3. Age-adjusted one-year prevalence of migraine in three different social groups according to age strata.

| Age interval	Blood donors (n = 119)			Workers (n = 79)			Students (n = 298)		
	Male (n = 25)	Female (n = 94)	All (n = 119)	Male (n = 52)	Female (n = 27)	All (n = 79)	Male (n = 48)	Female (n = 250)	All (n = 298)
<20	0.3%	4.0%	1.7%	0%	0%	0%	0.7%	8.1%	4.0%
20–24	0.7%	7.0%	2.9%	0.4%	10.6%	1.1%	3.7%	11.8%	7.5%
25–29	0.8%	1.6%	1.3%	1.3%	4.0%	1.4%	0%	6.7%	7.1%
30–34	0.7%	1.2%	1.2%	1.4%	0.9%	1.1%	0%	9.8%	5.9%
35–39	1.0%	1.2%	1.3%	1.0%	0.6%	0.8%	0%	5.4%	4.1%
40–44	0.8%	1.4%	1.4%	0.3%	0.3%	0.3%	0%	0%	0%
45–49	0.0%	1.2%	0.9%	0.3%	2.1%	0.7%	0%	0%	0%
50–54	0.0%	0.9%	0.7%	0.1%	0.5%	0.2%	0%	0%	0%
≥55	0.0%	0.2%	0.3%	0%	0.2%	0%	0%	0%	0%
All	4.5%	18.7%	11.7%	4.9%	19.2%	5.7%	4.5%	41.9%	28.6%
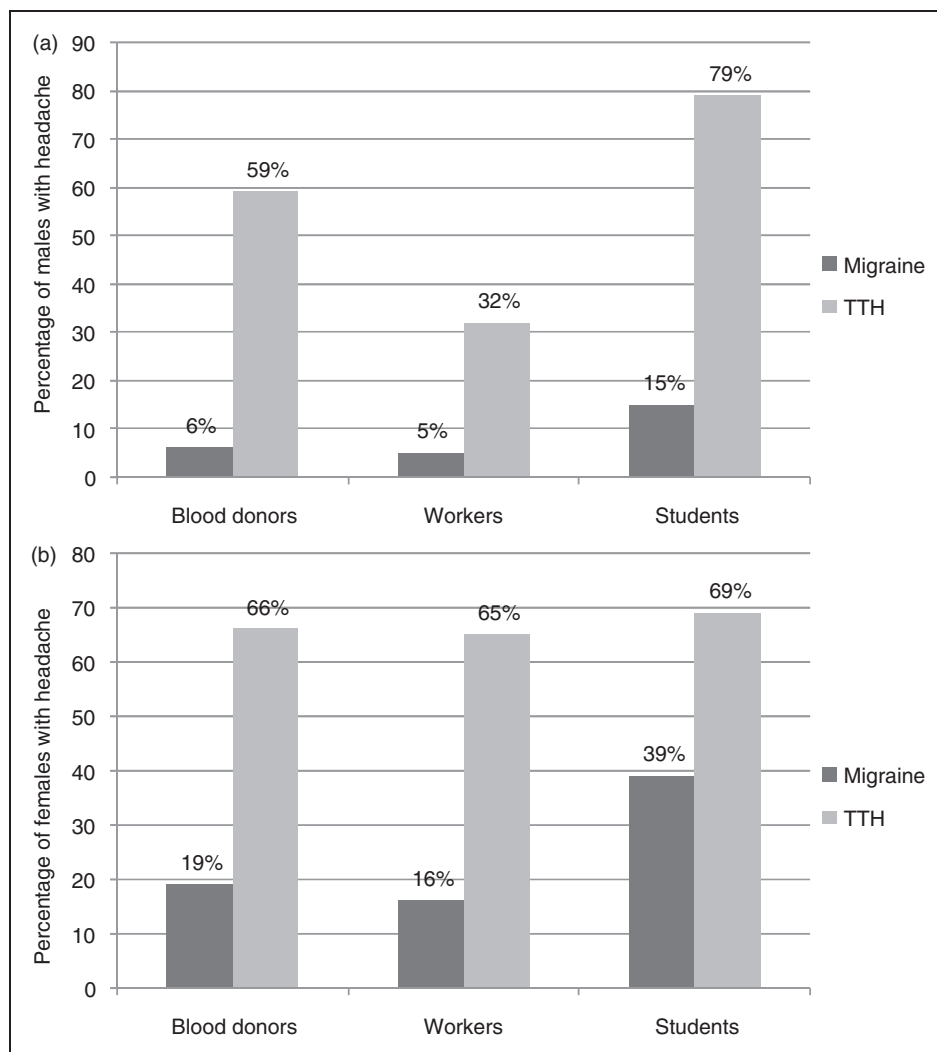
Figure 1. One-year crude prevalence of migraine and tension-type headache (TTH) in males (a) and females (b) in three different social groups.

Table 4. Age-adjusted one-year prevalence of TTH in three different social groups according to age strata.

Age interval	Blood donors (n = 685)			Workers (n = 457)			Students (n = 968)		
	Male (n = 323)	Female (n = 362)	All (n = 685)	Male (n = 356)	Female (n = 101)	All (n = 457)	Male (n = 284)	Female (n = 684)	All (n = 968)
<20	1.7%	13.3%	5.5%	0%	0%	0%	4.0%	13.7%	8.2%
20–24	15.5%	30.9%	21.9%	7.1%	31.7%	10.5%	18.7%	33.8%	25.2%
25–29	9.1%	5.1%	7.5%	5.8%	5.4%	4.8%	10.9%	5.4%	8.5%
30–34	7.6%	3.5%	5.9%	4.0%	3.5%	3.3%	11.9%	4.9%	8.9%
35–39	5.2%	3.5%	4.7%	3.0%	2.9%	2.6%	10.3%	5.4%	8.2%
40–44	6.1%	3.4%	4.9%	3.1%	3.6%	2.8%	0%	5.6%	8.1%
45–49	5.3%	3.8%	4.8%	2.8%	3.7%	2.8%	0%	0%	0%
50–54	5.2%	3.3%	4.4%	3.2%	4.8%	3.4%	0%	0%	0%
≥55	2.5%	1.9%	2.5%	1.7%	1.5%	1.5%	0%	0%	0%
All	58.1%	66.7%	62.0%	30.7%	57.0%	31.9%	55.8%	68.8%	67.1%

Table 5. Age at onset of primary headache in blood donors, workers and students.

Headache	Mean age at onset of headache			
	Blood donors	Workers	Students	All
Migraine without aura	22.3	27.1	12.7	20.7
Migraine with aura	21.8	24.4	12.7	17.3
Tension-type headache	22.5	32.6	13.8	22.9
Cluster headache	–	–	19.0	19.0
Any headache	22.6	32.4	13.6	20.3

workers had a significantly lower prevalence of TTH (30.7%).

In the entire cohort the mean age at onset of any headache was 20.3 years; in students 13.6 years, in workers 32.4 years and in blood donors 22.6 years. The mean age at onset of migraine was less than of TTH in all groups (Table 5).

Migraine and TTH are presented according to frequency of days with headache in Table 6. Most participants had headache one to seven days per year: 51% with TTH and 31% with migraine. Only a few participants had a frequency of ≥180 days per year: 3% with TTH and 1.1% with migraine. Students had more frequent headaches, workers the least frequent and blood donors had intermediate frequency. Females had more frequent headaches (31–179 and ≥180 days per year) than males ($p < 0.001$). Male and female students had the most frequent migraine and TTH (31–179 and ≥180 days per year) compared to workers and blood donors

($p < 0.001$). Male and female workers had the lowest frequency of migraine and TTH ($p < 0.001$).

Discussion

We demonstrated a prevalence of primary headache disorders using ICHD-3 beta that is similar to previous studies using ICHD-2. We showed major differences in the prevalence of migraine and TTH among social groups. Groups with a high prevalence of a headache disorder also had a high frequency of attacks; for example, females had a higher frequency of attacks than males and students a higher frequency than workers.

One-year prevalence of primary headache disorders

Using ICHD-3 beta, our study demonstrated a high one-year prevalence of headache disorders in Russia (67.5%) in accordance with a recent Russian study and many international studies using ICHD-2 (2,21). One-year prevalence of headache in other studies varied from 4.7% to 80.8% (22–45). The highest one-year prevalence of headache was found in Brazil, Finland and Denmark (1,5,38). The lowest one-year prevalence of headache was found in China (41).

The one-year prevalence of migraine was 15.9% (males 7%, females 27.5%) in our study. This is in accordance with data from the Global Burden of Disease Study 2010 (14.7%) (46) and almost the same as in many other counties. The one-year prevalence of migraine with aura (MA) was 2.4% in our study. It was higher in Denmark 4% (5). The one-year prevalence of MA in other countries was almost the same as in our study and even lower: in Austria 2.3% (17), and in

Table 6. Number of participants of three different social groups with tension-type headache (TTH) and migraine according to frequency of headaches in the previous year.

Type of headache and number of days with headache	Blood donors (N = 685)			Workers (N = 457)			Students (N = 968)			All
	Males (N = 323)	Females (N = 362)	All (N = 685)	Males (N = 356)	Females (N = 101)	All (N = 457)	Males (N = 284)	Females (N = 684)	All (N = 968)	All (N = 2110)
Migraine	17[a]	77	94	11	16	27	40	201	241	362
1–7	7 (41.2%)	23 (29.9%)	30 (31.9%)	8 (72.7%)	9 (56.2%)	17 (62.9%)	7 (17.5%)	57 (28.4%)	64 (26.6%)	111 (30.7%)
8–14	9 (52.9%)	27 (35.1%)	36 (38.3%)	1 (9.1%)	4 (25.0%)	5 (18.5%)	7 (17.5%)	33 (16.4%)	40 (16.6%)	81 (22.4%)
15–30	0 (0%)	14 (18.2%)	14 (14, 9%)	2 (18.2%)	3 (18.7%)	5 (18.5%)	10 (25.0%)	42 (20.9%)	52 (21.6%)	71 (19.6%)
31–179	0 (0%)	11 (14.3%)	11 (11.7%)	0 (0%)	0 (0%)	0 (0%)	16 (40.0%)	68 (33.8%)	84 (34.8%)	95 (26.2%)
≥180	1 (5.9%)	2 (2.6%)	3 (3.2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (0.5%)	1 (0.4%)	4 (1.1%)
TTH	290[b]	349	639	350	100	450	123	334	457	1546
1–7	173 (27.1%)	149 (42.7%)	322 (50.4%)	260 (74.3%)	61 (61.0%)	321 (71.3%)	54 (43.9%)	88 (26.3%)	142 (31.1%)	785 (50.8%)
8–14	67 (23.1%)	90 (25.8%)	157 (24.6%)	51 (14.6%)	9 (9.0%)	60 (13.3%)	21 (17.1%)	66 (19.7%)	87 (19.0%)	304 (19.6%)
15–30	32 (11.0%)	50 (14.3%)	82 (12.8%)	24 (6.9%)	10 (10.0%)	34 (7.6%)	21 (17.1%)	65 (9.5%)	86 (18.8%)	202 (13.8%)
31–179	14 (4.8%)	45 (12.9%)	59 (9.3%)	13 (3.7%)	16 (16.0%)	29 (6.4%)	26 (21.1%)	94 (28.1%)	120 (26.3%)	208 (9.6%)
≥180	4 (1.4%)	15 (4.3%)	19 (2.9%)	2 (0.6%)	4 (4.0%)	6 (1.3%)	1 (0.3%)	21 (4.2%)	22 (4.8%)	47 (3.0%)

[a]Data about frequency of migraine were indicated only for those participants who had information about this.
[b]Data about frequency of TTH were indicated only for those participants who had information about this.

Ethiopia 2.6% (35). Many studies did not investigate the prevalence of MA at all.

Episodic TTH was the most prevalent primary headache in our study: 57.4% (71.6% in females, 49% in males, female/male ratio 1.5:1). It was higher than in the first epidemiological study of headache in Russia (30.8%). Our data are in accordance with Rasmussen et al. (5) in Denmark who found 74%. The lowest one-year prevalence of TTH was found in Ethiopia, China and Germany.

The one-year prevalence of chronic headache in our study was almost the same as in many other epidemiological studies in other countries. In Russia Ayzenberg et al. found, however, a significantly higher prevalence of chronic headache (10.5% vs our 1.7%) (21). In Georgia it was also higher (7.6%) (28). This difference can perhaps be explained by an almost total absence of participants from villages and from low social strata in our study.

Headache prevalence differs among social groups

Blood donors had prevalence in line with the general population in many previous studies as cited above. The lower prevalence of any headache in workers was because male workers had a lower prevalence of TTH. Students stood out with a higher prevalence of migraine but also of TTH. The above differences were strengthened by the fact that students also had a higher frequency of days with migraine and TTH while workers had a lower frequency. These results were largely unchanged by age correction using our own data. If we had used data published by others (47,48), the differences among social groups would have been even higher than the uncorrected values because the prevalence of migraine and TTH was shown to increase up to the age of 40. In our study workers were an average age of 40.4 while donors were age 34.1 and students 20.6.

The low prevalence of TTH in male workers may relate to their physical work and selection of the fittest for these highly paid jobs. We cannot exclude that male workers disregarded TTH as part of a macho attitude or because they would not consent to any weakness as part of the health examination that was paid for by the employer fearing consequences for their employment.

We can compare our results in workers with two studies among workers of a textile factory in Ethiopia (35). The one-year prevalence of migraine was 6.2% and of TTH 9%, almost the same as in workers in our study (7.3%), but the prevalence of TTH was significantly lower than in our study (37%). A low prevalence of headache in workers suggests that physical work may be associated with reduced prevalence of headache, especially TTH. However, heavy physical work may not alter the prevalence of TTH as the

one-month prevalence of headache in heavy engineering workers in Turkey was 43.2% (11).

More striking was the very high prevalence of migraine, TTH and probable medication-overuse headache in students. Several previous studies of the prevalence of headache disorders in students showed prevalence of migraine in the range 6.4%–28.4% and of TTH in the range 18%–44.2%. The lowest prevalence of migraine was found in Nigeria (6.4%) and Norway (6.4%) (1,37) and the highest in Poland (28.4%) and Turkey (21.9%) (16,27). We found a prevalence of 28.6% in students. TTH was investigated only in a few studies in students. The one-year prevalence was 18% in Norway, 18% in Nigeria and 44.2% in Iran (1,37,40). In our study it was significantly higher: 74.5%. Our impression is that other studies may have missed the infrequent TTH individuals in whom TTH is really not a problem. In our study they accounted for 60% of all TTH cases.

Strengths and weaknesses of our study

A strength of our study was that we used the ICHD-3 beta for an epidemiological study for the first time. Furthermore, we used a direct interview and a validated semi-structured interview instead of a questionnaire. We studied different social groups and each group had a very large size for a direct interview study. The different age and sex distribution of the three social groups was impossible to avoid. This will be the case for all studies comparing social groups because age and sex distributions will always differ in contrast to classical population-based epidemiological studies. We compensated for the influence of age and sex by age- and sex-specific comparisons and present only such comparisons of social groups. A challenge is the low level of awareness of headache disorders in the Russian population causing difficulty eliciting a precise history in participants having more than one headache disorder. Our use of medical students for one-third of the interviews might also be a weakness. We used, however, only senior students and trained them carefully. Nevertheless their interviews were sometimes incomplete but in such cases we re-interviewed the participants. Our results cannot be generalized to the whole Russian population because we had almost no participants from villages or from low social strata.

Conclusions

We found that the prevalence of primary headache disorders using ICHD-3 beta was similar to previous findings in other countries with ICHD-2. Social groups have markedly different prevalence of migraine and TTH. Very high prevalence in university

students merits further investigation and preventive efforts. Our findings underline that headache epidemiology in the future should focus on socially defined groups in order to target future preventive efforts.

Public health relevance

1. The prevalence of migraine and tension-type headache (TTH) according to the third edition beta of the International Classification of Headache Disorders (ICHD-3 beta) is similar to the prevalence with ICHD-2.
2. There are major differences in the prevalence of migraine and TTH between social groups.
3. Social groups with a high prevalence of a headache disorder also had a high frequency of attacks.
4. Females have not only a higher prevalence but also a greater frequency of attacks.
5. Headache epidemiology in the future should focus on socially defined groups in order to target preventive efforts.

References

1. Stovner L, Hagen K, Jensen R, et al. The global burden of headache: A documentation of headache prevalence and disability worldwide. *Cephalalgia* 2007; 27: 193–210.
2. Stovner LJ and Colette A. Prevalence of headache in Europe: A review for the Eurolight project. *J Headache Pain* 2010; 11: 289–299.
3. Linde M, Stovner LJ, Zwart JA, et al. Time trends in the prevalence of headache disorders. The Nord-Trondelag health studies (HUNT 2 and HUNT 3). *Cephalalgia* 2011; 31: 585–596.
4. Merikangas KR, Cui L, Richardson K, et al. Magnitude, impact, and stability of primary headache subtypes: 30 year prospective Swiss cohort study. *BMJ* 2011; 343: d5076.
5. Rasmussen BK, Jensen R, Schroll M, et al. Epidemiology of headache in a general population: A prevalence study. *J Clin Epidemiol* 1991; 44: 1147–1157.
6. Crystal SC and Robbins MS. Epidemiology of tension-type headache. *Curr Pain Headache* 2010; 14: 449–454.
7. Robbins MS and Lipton RB. The epidemiology of primary headache disorders. *Semin Neurol* 2010; 30: 107–119.
8. Lipton RB, Bigal ME, Kolodner K, et al. The family impact of migraine: Population-based studies in the US and UK. *Cephalalgia* 2003; 23: 429–440.
9. Le H, Tfelt-Hansen P, Skytthe A, et al. Association between migraine, lifestyle and socioeconomic factors: A population-based cross-sectional study. *J Headache Pain* 2011; 12: 157–172.
10. The International Classification of Headache Disorders, 3rd edition (beta version). *Cephalalgia* 2013; 33: 629–808.
11. Selekler MH, Gökmen G and Steiner TJ. Productivity impact of headache on a heavy-manufacturing workforce in Turkey. *J Headache Pain* 2013; 14: 88.
12. Takele GM, Haimanot RT and Martelletti P. Prevalence and burden of primary headache in Akaki textile mill workers, Ethiopia. *J Headache Pain* 2008; 9: 119–128.
13. Kurt S and Kaplan Y. Epidemiological and clinical characteristics of headache in university students. *Clin Neurol Neurosurg* 2008; 110: 46–50.
14. Oztora S, Korkmaz O, Dagdeviren N, et al. Migraine headaches among university students using ID Migraine test as a screening tool. *BMC Neurology* 2011; 11: 103.
15. Semiz M, Şentürk İA, Balabann H, et al. Prevalence of migraine and comorbid psychiatric disorders among students of Cumhuriyet University. *J Headache Pain* 2013; 14: 34.
16. Split W and Neuman W. Epidemiology of migraine among students from randomly selected secondary schools in Lodz. *Headache* 1999; 39: 494–501.
17. Lampl C, Buzath A, Baumhackl U, et al. One-year prevalence of migraine in Austria: A nation-wide survey. *Cephalalgia* 2003; 23: 280–286.
18. Turner JC. Towards a cognitive redefinition of the social group. In: Tajfel H (ed.) *Social identity and intergroup relations*. Cambridge, UK: Cambridge University Press, 1982, pp.15–40.
19. Gervil M, Ulrich V, Olesen J, et al. Screening for migraine in the general population: Validation of a simple questionnaire. *Cephalalgia* 1998; 18: 342–348.

20. Schokkaert E and Van de Voorde C. Direct versus indirect standardization in risk adjustment. *J Health Econ* 2009; 28: 361–374.

21. Ayzenberg I, Katsarava Z, Sborowski A, et al. The prevalence of primary headache disorders in Russia: A countrywide survey. *Cephalalgia* 2012; 32: 373–381.

22. Lyngberg AC, Rasmussen BK, Jorgensen T, et al. Incidence of primary headache: A Danish epidemiologic follow-up study. *Am J Epidemiol* 2005; 161: 1066–1073.

23. Russell MB, Rasmussen BK, Thorvaldsen P, et al. Prevalences and sex-ratios of the subtypes of migraine. A population based epidemiological survey of four thousand 40 years old males and females. *Int J Epidemiol* 1995; 24: 612–618.

24. Ulrich V, Russell MB, Jensen R, et al. A comparison of tension-type headache in migraineurs and non-migraineurs: A population-based study. *Pain* 1996; 67: 501–506.

25. Ertas M, Baykan B, Orhan E, et al. One-year prevalence and the impact of migraine and tension-type headache in Turkey: A nationwide home-based study in adults. *J Headache Pain* 2012; 13: 147–157.

26. Balaban H, Semiz M, Şentürk IA, et al. Migraine prevalence, alexithymia, and post-traumatic stress disorder among medical students in Turkey. *J Headache Pain* 2012; 13: 459–467.

27. Bicakci S, Bozdemir N, Over F, et al. Prevalence of migraine diagnosis using ID Migraine among university students in southern Turkey. *J Headache Pain* 2008; 9: 159–163.

28. Katsarava Z, Dzagnidze A, Kukava M, et al. Primary headache disorders in the Republic of Georgia. Prevalence and risk factor. *J Neurology* 2009; 73: 1796–1803.

29. Vuković-Cvetković V, Plavec D and Lovrenčić-Huzjan A. Prevalence of chronic headache in Croatia. *Biomed Res Int* 2013; 2013: 837613.

30. Galinović I, Vuković V, Troselj M, et al. Migraine and tension-type headache in medical students: A questionnaire study. *Coll Antropol* 2009; 33: 169–173.

31. Moldovanu I, Odobescu S and Craciun C. Medication overuse in Moldova. Chronic migraine with and without medication overuse: The role of drug phobia and associated factors (according to the data of Headache Centre, Chisinau, the Republic of Moldova). *Cephalalgia* 2008; 28: 1229–1233.

32. Matías-Guiu J, Porta-Etessam J and Mateos V. One-year prevalence of migraine in Spain: A nationwide population-based survey. *Cephalalgia* 2011; 31: 463–470.

33. Yoon MS, Katsarava Z, Obermann M, et al. Prevalence of primary headaches in Germany: Results of the German Headache Consortium Study. *J Headache Pain* 2012; 13: 215–222.

34. Steiner TJ, Scher AI, Stewart WF, et al. The prevalence and disability burden of adult migraine in England and their relationships to age, gender and ethnicity. *Cephalalgia* 2003; 23: 519–527.

35. Mengistu G and Alemayehu S. Prevalence and burden of primary headache disorders among a local community in Addis Ababa, Ethiopia. *J Headache Pain* 2013; 14: 543–550.

36. Adoukonou T, Tognon-Tchegnonsi F, Philomène K, et al. Prevalence of migraine among university students at Parakou, Benin: A cross-sectional study. *World J Neurosci* 2014; 4: 18–24.

37. Ojini FI, Okubadejo NU and Danesi MA. Prevalence and clinical characteristics of headache in medical students of the University of Lagos, Nigeria. *Cephalalgia* 2009; 29: 472–477.

38. Queiroz LP, Peres MF, Kowacs F, et al. Chronic daily headache in Brazil: A nationwide population-based study. *Cephalalgia* 2008; 28: 1264–1269.

39. Victor TW, Hu X, Campbell JC, et al. Migraine prevalence by age and sex in the United States: A life-span study. *Cephalalgia* 2010; 30: 1065–1072.

40. Ghorbani A, Abtahi SM, Fereidan-Esfahani M, et al. Prevalence and clinical characteristics of headache among medical students, Isfahan, Iran. *J Res Med Sci* 2013; 18(Suppl 1): S24–S27.

41. Kim B, Chu M, Lee T, et al. Prevalence and impact of migraine and tension-type headache in Korea. *J Clin Neurol* 2012; 8: 204–211.

42. Liu R, Yu S, He M, et al. Health-care utilization for primary headache disorders in China: A population-based door-to-door survey. *J Headache Pain* 2013; 14: 47.

43. Yu S, Liu R, Zhao G, et al. The prevalence and burden of primary headaches in China: A population-based door-to-door survey. *Headache* 2012; 52: 582–591.

44. Rao G, Kulkarni G, Gururaj G, et al. The burden of headache disorders in India: Methodology and questionnaire validation for a community-based survey in Karnataka State. *J Headache Pain* 2012; 13: 543–550.

45. Yokoyama M, Yokoyama T, Yokoyama A, et al. Interactions between migraine and tension-type headache and alcohol drinking, alcohol flushing and hangover in Japanese. *J Headache Pain* 2012; 13: 137–145.

46. Vos T, Flaxman AD, Naghavi M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: A systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012; 380: 2163–2196.

47. Schwartz BS, Stewart WF, Simon D, et al. Epidemiology of tension-type headache. *JAMA* 1998; 279: 381–383.

48. Buse DC, Loder EW, Gorman JA, et al. Sex differences in the prevalence, symptoms, and associated features of migraine, probable migraine and other severe headache: Results of the American Migraine Prevalence and Prevention (AMPP) Study. *Headache* 2013; 53: 1278–1299.