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# The PACE study: past-year prevalence of tension-type headache and its subtypes in Parma's adult general population

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**Abstract** The mean global prevalence of tension-type headache (TTH) in adult is 42 %. To date, there have been no Italian studies on TTH prevalence in the adult general population. Therefore, we conducted a cross-sectional study, called PACE, aimed at detecting the prevalence of primary headaches in the city of Parma's adult general population. 904 subjects representative of Parma's adult general population were interviewed face to face by a physician of our Headache Centre. Crude past-year prevalence for definite TTH was 19.4 % (95 % CI 16.8–21.9; 18.4 %, 95 % CI 14.6–22.3 in men, and 20.1 %, 95 % CI 16.6–23.6 in women), namely, 9.0 % (95 % CI 7.1–10.8) for infrequent TTH, 9.8 % (95 % CI 7.9–11.8) for frequent TTH, and 0.6 % (95 % CI 0.1–1) for chronic TTH. Crude prevalence for probable TTH was 2.3 % (95 % CI 1.3–3.3; 2 %, 95 % CI 0.6–3.4 in men, and 2.6 %, 95 % CI 1.2–3.9 in women). Our results indicate a TTH prevalence (19.4 %) at the lower limit of data ranges for Western countries, and prevalence rates for infrequent forms (9 %) do not appear different from those of frequent forms (9.8 %).

**Keywords** Headache · Tension-type headache · Prevalence

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## Introduction

Primary headaches represent a problem for public health systems because they have a high prevalence, are spread all over the world and are associated with a lot of medical comorbidities [1, 2]. Many studies have been conducted worldwide to determine migraine prevalence [3], while there have been few studies on tension-type headache (TTH), the majority of these are from Europe.

TTH has a mean global prevalence of 42 % [3], but figures all over the world differ widely. No Italian studies on TTH prevalence in the general population aged 18 years or over have been available after the publication of the IHS diagnostic criteria [6]. Prencipe et al. [7] found a TTH prevalence rate of 44.5 % among 833 Italians aged 65 or over living in three rural villages near L'Aquila, a city in the Abruzzo region of central Italy. Prevalence rates were significantly higher in women (55.1 %) than in men (30.9 %; F:M ratio = 2.4), and a significant inverse association between TTH prevalence and advancing age was found.

The PACE study is a cross-sectional study aimed at detecting the prevalence and clinical features of primary headaches in the city of Parma's adult general population: we report data about the past-year prevalence of TTH and its subtypes.

## Materials and methods

Our survey was conducted between September 2007 and February 2009 in Parma, a city in the Emilia-Romagna region of Northern Italy. As of 31 December 2006 (Table 1), the city had 152,140 inhabitants aged  $\geq 18$  years (71,280 men and 80,860 women). The official census of

**Table 1** Gender and age distribution of Parma's general population of the initial sample and of responders

Age (years)	Parma's general population <sup>a</sup>						Initial sample <sup>b</sup>						Responders <sup>c</sup>					
	F		M		Total		F		M		Total		F		M		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
18–29	10,253	12.7	10,582	14.9	20,835	13.7	82	12.1	69	11.7	151	11.9	51	10.0	33	8.3	84	9.3
30–39	15,105	18.7	15,208	21.3	30,313	19.9	86	12.6	93	15.8	179	14.1	55	10.8	51	12.9	106	11.7
40–49	13,834	17.1	13,845	19.4	27,679	18.2	98	14.4	104	17.7	202	15.9	78	15.4	61	15.4	139	15.4
50–59	11,738	14.5	10,628	14.9	22,366	14.7	106	15.6	98	16.6	204	16.1	96	18.9	74	18.7	170	18.8
60–69	11,505	14.2	9,925	13.9	21,430	14.1	103	15.1	103	17.5	206	16.2	86	16.9	88	22.2	174	19.2
70–79	10,059	12.4	7,239	10.2	17,298	11.4	107	15.7	81	13.8	188	14.8	93	18.3	64	16.2	157	17.4
>79	8,366	10.4	3,853	5.4	12,219	8.0	99	14.5	41	6.9	140	11.0	49	9.6	25	6.3	74	8.2
Total	80,860	53.1	71,280	46.9	152,140		681	53.6	589	46.4	1,270		508	56.2	396	43.8	904	

<sup>a</sup> Parma's general population as of 31 December 2006 ([www.statistica.comune.parma.it](http://www.statistica.comune.parma.it))

<sup>b</sup> Patients registered in the lists of one general practitioner

<sup>c</sup> Subjects that completed the questionnaire

Parma residents as of 31 December 2006 was provided by the Parma Municipal Statistics Office [8].

### Sampling

Our initial study sample consisted of all residents registered with a general practitioner (GP) in downtown Parma. Electronic patient records for the GP practice (as of 1 January 2007) were officially provided by the Parma local health care unit of Italy's National Health Service (NHS).

Our study population can be considered representative of the Italian adult general population, because in Italy primary care must be provided by a physician free of charge to each citizen from birth. Italy's NHS keeps official records of patients in the practice of each primary care provider. For primary care providers to best fulfill their role, patients must be free to make their choice with no geographic, administrative, or economic constraints. Our choice of the initial study sample was influenced by the number of patients in the GP's practice ( $n = 1,300$ ), as well as by the successful results of past cooperations with our team [9]. We removed all subjects aged <18 years from the list. Our initial study sample consisted of 1,270 subjects, 681 women and 589 men.

### Interview and case definition

The interview was conducted face to face by one of the physicians of the Parma Headache Centre and consisted in the administration of a specially designed, previously validated 13-section questionnaire for the diagnosis of primary headaches in the general population [10]. A neurological examination was made except for subjects

unable to reach the appointment venue, that were interviewed by phone. The questionnaire included a screening question "Have you had headache in the last year?" that made it possible to detect subjects with past-year headache. Through questions in the section about headache, it was possible to diagnose the primary headache types that each subject was suffering from. The diagnosis was based on the ICHD-II criteria [11]. The questionnaire versus the clinical interview showed an excellent concordance rate ( $K$  value = 0.96, 95 % CI 0.88–1) for the first diagnosis and a good concordance rate for the second diagnosis ( $K$  value 0.61, 95 % CI 0.47–0.74). Sensitivity for infrequent episodic TTH (iTTH, ICHD-II code 2.1), frequent episodic TTH (fTTH, ICHD-II code 2.2), and pTTH (ICHD-II code 2.4) was 100 %; sensitivity for chronic TTH (cTTH, ICHD-II code 2.3) was 66.6 % (95 % CI 54–80). Specificity was 100 %, except for iTTH (93.7 %, 95 % CI 86–100) [10]. Subjects with only one headache attack in the last year were included in the iTTH group if they had had at least ten lifetime episodes.

### Statistics

Crude prevalence was the number of cases every 100 inhabitants. Crude prevalence was standardized by sex and age in Parma's general population aged 18 or over according to the 2006 census [8]. We used the Chi-square test for frequencies' difference and Student's  $t$  test for means comparison. The 95 % CIs for prevalence were calculated using the method suggested by Schoenberg [12]. Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS), version 17.0 for Windows.

## Ethics

The study was approved by the University of Parma Ethics Board on 13 February 2007. All subjects gave their informed consent.

## Results

### Responders and representativeness

The 904 responders (71.2 % of the initial study sample) included 508 women (56.2 %; mean age 55.9 years, SD 17.2 years, max. 92 years) and 396 men (43.8 %; mean age 55.0 years, SD 18.2 years, max. 91 years). In 89 cases (48 men and 41 women), the interview was conducted by phone. No statistically significant differences were found in gender and age distribution between Parma's general population, the initial study sample and responders. The only exception was the 18-to-29-year age group, which showed a difference between responders and the general population ( $p = 0.046$ ) (Table 1).

### Non-responders

366 subjects (173 women, 47.3 %, and 193 men, 52.7 %) could not be recruited for the study due to reasons reported in Fig. 1. There were significantly fewer women than men ( $p = 0.005$ ), especially in the 40–49 ( $p = 0.002$ ) and 50–59 ( $p = 0.007$ ) age groups. Mean age was 55.5 years (SD 17.8 years, max. 92 years) for responders and 51.9 years (SD 17.6 years, max. 89 years) for non-responders ( $p = 0.001$ ).

### Crude prevalence

Crude prevalence rates by gender and age for dTTH, iTTH, fTTH and cTTH are reported in Table 2A–D.

A total of 175 subjects (19.4 %, 95 % CI 16.8–21.9) had a diagnosis of dTTH: 102 were women (20.1 %, 95 % CI

16.6–23.6) and 73 were men (18.4 %, 95 % CI 14.6–22.3) with an F:M ratio of 1.1:1 (Fig. 2a). Age distribution showed a stable prevalence until age 70, followed by a decreasing trend in the next life decades; in women this decrease in prevalence seemed to occur earlier than in men, beginning in the sixth decade (Table 2A). Eighty-one subjects (9 %, 95 % CI 7.1–10.8) had iTTH, 45 of them female (8.9 %, 95 % CI 6.4–11.3) and 36 male (9.1 %, 95 % CI 6.3–11.9; F:M ratio = 1:1; Fig. 2b); (b) 89 subjects (9.8 %, 95 % CI 7.9–11.8) had fTTH, 54 of them female (10.6 %, 95 % CI 7.9–13.3) and 35 male (8.8 %, 95 % CI 6–11.6; F:M ratio = 1.2:1; Fig. 2c); (c) for cTTH, crude prevalence was 0.6 %, 95 % CI 0.1–1 (0.6 %, 95 % CI 0–1.3 in women; 0.5 %, 95 % CI 0–1.2 in men; F:M ratio = 1.2:1; Fig. 2d).

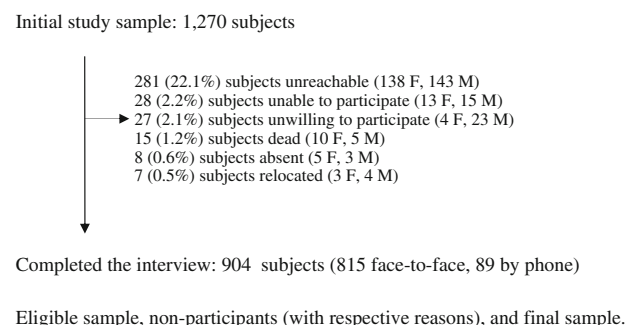
Crude prevalence by gender and age for pTTH is reported in Table 2E. Twenty-one subjects had pTTH (2.3 %, 95 % CI 1.3–3.3), 13 of them female (2.6 %, 95 % CI 1.2–3.9) and eight male (2 %, 95 % CI 0.6–3.4) with an F:M ratio of 1.3:1 (Fig. 2e).

### Adjusted prevalence

Adjusted prevalence for dTTH was 20.5 % (95 % CI 17.8–23.1), i.e., 19.4 % (95 % CI 15.5–23.3) in men and 21.2 % (95 % CI 17.6–24.8) in women. Of the patients studied, 9.4 % (95 % CI 7.5–11.3) had iTTH (9.8 %, 95 % CI 6.9–12.7 in men; 9.2 %, 95 % CI 6.7–11.7, in women), 10.6 % (95 % CI 8.6–12.6) had fTTH (9.3 %, 95 % CI 6.4–12.2 in men; 11.5 %, 95 % CI 8.7–14.2 in women), and 0.6 % (95 % CI 0.1–1) had cTTH (0.6 %, 95 % CI 0–1.3 in men; 0.6 %, 95 % CI 0–1.2 in women). Adjusted prevalence for pTTH was 2.4 %, 95 % CI 1.4–3.4 (2.2 %, 95 % CI 0.8–3.7 in men; 2.5 %, 95 % CI 1.1–3.8 in women).

## Discussion

The crude past-year prevalence of dTTH in Parma's adult general population was 19.4 %, without differences in sex distribution. This is the first population-based study on TTH past-year prevalence conducted in Italy on adult subjects aged 18 or over since the publication of the IHS diagnostic criteria in 1988 [6]; Italian data currently available for the prevalence of this headache subtype concern subjects aged 65 or over [7, 13]. Data on TTH prevalence in adult populations are available from the international literature. In Table 3, we report population-based studies on past-year TTH prevalence conducted all over the world since 1988 and their respective results [4, 5, 7, 13–33]. In European countries, the past-year prevalence of dTTH ranges from 5.1 % in Eastern Europe [4] to

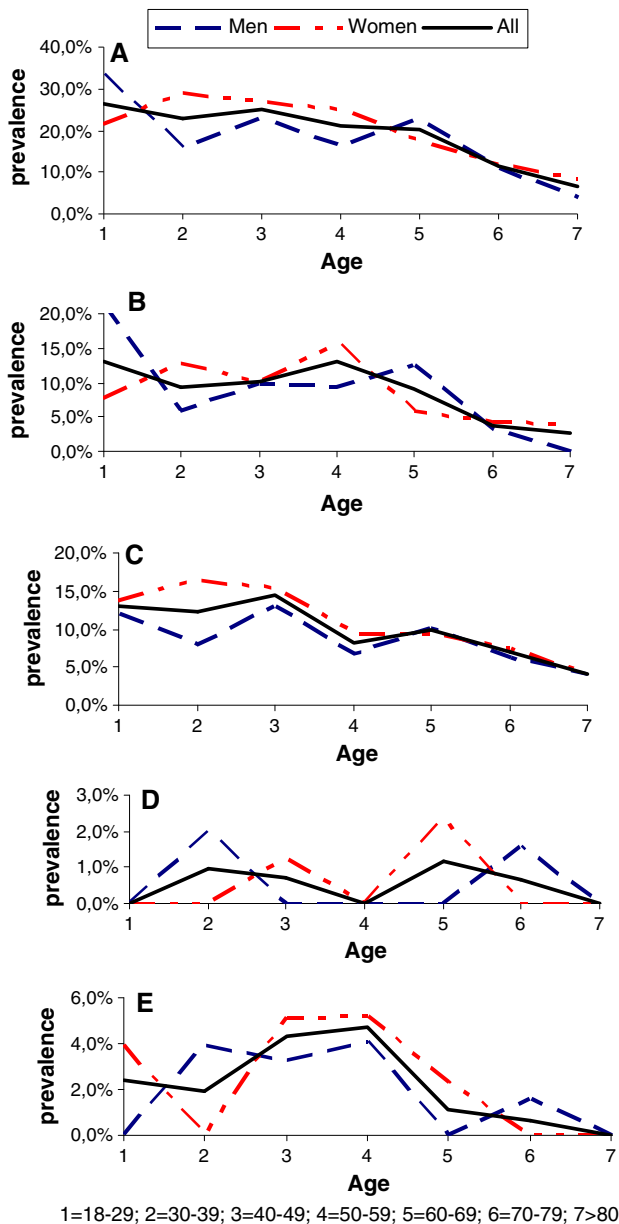


**Fig. 1** Study population flow chart

**Table 2** Crude past-year prevalence of tension-type headache (TTH) by age and gender

Age (years)	M			F			Total		
	<i>n</i>	%	95 % CI	<i>n</i>	%	95 % CI	<i>n</i>	%	95 % CI
<b>(A) Definite TTH<sup>a</sup></b>									
18–29	11	33.3	17.2–49.4	11	21.6	10.3–32.9	22	26.2	16.8–35.6
30–39	8	15.7	5.7–25.7	16	29.1	17.1–41.1	24	22.6	14.7–30.6
40–49	14	23.0	12.4–33.5	21	26.9	17.1–36.8	35	25.2	18.0–32.4
50–59	12	16.2	7.8–24.6	24	25.0	16.3–33.7	36	21.2	15.0–27.3
60–69	20	22.7	14.0–31.5	15	17.4	9.4–25.5	35	20.1	14.2–26.1
70–79	7	10.9	3.3–18.6	11	11.8	5.3–18.4	18	11.5	6.5–16.4
>79	1	4.0	0–11.7	4	8.2	0.5–15.8	5	6.8	1.0–12.5
Total	73	18.4	14.6–22.3	102	20.1	16.6–23.6	175	19.4	16.8–21.9
<b>(B) Infrequent episodic TTH</b>									
18–29	7	21.2	8–35.2	4	7.8	0.5–15.2	11	13.1	5.9–20.3
30–39	3	5.9	0–12.3	7	12.7	3.9–21.5	10	9.4	3.9–15.0
40–49	6	9.8	2.4–17.3	8	10.3	3.5–17.0	14	10.1	5.1–15.1
50–59	7	9.5	2.8–16.1	15	15.6	8.4–22.9	22	12.9	7.9–18.0
60–69	11	12.5	5.6–19.4	5	5.8	0.9–10.8	16	9.2	4.9–13.5
70–79	2	3.1	0–7.4	4	4.3	0.2–8.4	6	3.8	0.8–6.8
>79	–	–	–	2	4.1	0–9.6	2	2.7	0–6.4
Total	36	9.1	6.3–11.9	45	8.9	6.4–11.3	81	9.0	7.1–10.8
<b>(C) Frequent episodic TTH</b>									
18–29	4	12.1	1.0–23.3	7	13.7	4.3–23.2	11	13.1	5.9–20.3
30–39	4	7.8	0.5–15.2	9	16.4	6.6–26.1	13	12.3	6.0–18.5
40–49	8	13.1	4.6–21.6	12	15.4	7.4–23.4	20	14.4	8.6–20.2
50–59	5	6.8	1.0–12.5	9	9.4	3.5–15.2	14	8.2	4.1–12.4
60–69	9	10.2	3.9–16.6	8	9.3	3.2–15.4	17	9.8	5.4–14.2
70–79	4	6.3	0.3–12.2	7	7.5	2.2–12.9	11	7.0	3.0–11.0
>79	1	4.0	0–11.7	2	4.1	0–9.6	3	4.1	0–8.5
Total	35	8.8	6.0–11.6	54	10.6	7.9–13.3	89	9.8	7.9–11.8
<b>(D) Chronic TTH</b>									
18–29	–	–	–	–	–	–	–	–	–
30–39	1	2.0	0–5.8	–	–	–	1	0.9	0–2.8
40–49	–	–	–	1	1.3	0–3.8	1	0.7	0–2.1
50–59	–	–	–	–	–	–	–	–	–
60–69	–	–	–	2	2.3	0–5.5	2	1.1	0–2.7
70–79	1	1.6	0–4.6	–	–	–	1	0.6	0–1.9
>79	–	–	–	–	–	–	–	–	–
Total	2	0.5	0–1.2	3	0.6	0–1.3	5	0.6	0.1–1
<b>(E) Probable TTH</b>									
18–29	–	–	–	2	3.9	0–9.2	2	2.4	0–5.6
30–39	2	3.9	0–9.2	–	–	–	2	1.9	0–4.5
40–49	2	3.3	0–7.7	4	5.1	0.2–10.0	6	4.3	0.9–7.7
50–59	3	4.1	0–8.5	5	5.2	0.8–9.7	8	4.7	1.5–7.9
60–69	–	–	–	2	2.3	0–5.5	2	1.1	0–2.7
70–79	1	1.6	0–4.6	–	–	–	1	0.6	0–1.9
>79	–	–	–	–	–	–	–	–	–
Total	8	2.0	0.6–3.4	13	2.6	1.2–3.9	21	2.3	1.3–3.3

<sup>a</sup> Definite TTH represents the sum of infrequent episodic TTH, frequent episodic TTH and chronic TTH



**Fig. 2** Past-year crude prevalence of tension-type headache (TTH)

74.0 % in Western Europe [5]. Our results are in agreement with those of Vuković et al. [19] who in Croatia found a dTTH prevalence of 21.2 %, 23.2 % in women and 19.1 % in men. Fewer records exist from other continents: seven studies were conducted in Asia on the past-year prevalence of dTTH [23–29], and only two in both South America [30, 31] and Africa [32, 33]. The prevalence estimate in our study was slightly lower than the average in the Asian studies, which ranges from 10.8 % in China [29] to 36.9 % in Jordan [23]. Rates from the South American studies are comparable with 11.9 % in Brazil [31] and 26.9 % in Chile [30], while in the African studies they are lower than 10 %, namely, 9.4 % in Ethiopia [32] and 5.4 % in Tanzania [33].

To date, only one record exists from the USA and it comes from a study conducted in 1998 by Schwartz et al. [14], which indicates a past-year dTTH prevalence of 40.5 %. This figure is almost double that calculated in Parma; however, the rates are not comparable because the interview mode used in the US study is different from that of the PACE study (telephonic vs. face-to-face interviews). As regards TTH frequency in males and in females, in several studies, including ours, there was no disparity between genders [14, 22–24].

In our sample, the evaluation of past-year dTTH prevalence by age ranges shows a homogeneous distribution until the sixth decade. This finding is in agreement with most studies, which report a decrease in prevalence after age 60 [5, 14, 17, 31] and after age 70 [28]. Unlike migraine, whose prevalence decreases markedly after age 50 [34], TTH seems to last longer in the lives of those who suffer from it.

The past-year prevalence of TTH in Parma's adult general population was 9.8 % for fTTH, 9 % for iTTH, and 0.6 % for cTTH without differences in sex distribution.

Data in the international literature on episodic subtypes of TTH (iTTH and fTTH) are scarce. Data are entirely conflicting for the past-year prevalence of iTTH; about fTTH our results confirm Ayzenberg et al.'s [22] estimates (Table 3). Chronic TTH is the most widely studied subtype and it is less than 1 % prevalence rate that we found in this study is confirmed by several authors [4, 16, 31, 33]. In our sample, we found no gender differences in the distribution of cTTH, while some studies report a higher prevalence of cTTH in women than in men [14, 16, 18, 28, 30, 32].

The differences in the various sets of data existing on past-year dTTH prevalence can be attributed to a variety of reasons, including the variability of methodological approaches and the differences among study populations, which are mainly due to geographical, demographic, racial, economic, and psychosocial factors. As extensively discussed in our previous article on migraine prevalence [34], we believe that the reliability of our results may have been favored by some methodological aspects of our study, in particular: (a) the recruitment of the initial sample, more than 70 % of which was sex and age matched to Parma's general population; (b) the general question that started our interview ("Have you had headache in the last year"), which compared to questions on specific clinical features (such as severity) was more suitable for an early detection of sufferers; (c) the procedure followed, i.e., a face-to-face interview complete with neurological examination performed by a headache expert; and (d) the detection of all possible headache types reported by headache patients through the analysis of the clinical features of each type.

In conclusion, data on the epidemiology of TTH are highly variable. Our study results indicate a past-year

**Table 3** Population-based studies on past-year prevalence of tension-type headache (TTH) conducted all over the world since 1988

Country (year)	First author (references)	Method	n	Age range (years)	Definite TTH <sup>a</sup>			Chronic TTH			Frequent episodic TTH			Infrequent episodic TTH			Probable TTH			
					M %	F %	Total %	M %	F %	Total %	M %	F %	Total %	M %	F %	Total %	M %	F %	Total %	
USA (1998)	Schwartz [14]	TI	13,345	≥18	37.7	44.8	40.5	1.4	2.8	2.2										
Denmark (1991)	Rasmussen [5]	PI	740	25–64	63.0	86.0	74.0			3.0								44.0		
Denmark (2005)	Lyngberg [15]	PI	207	25–36	81.5	90.4	86.5			4.8								37.2		
Denmark (2006)	Russell [16]	Q	28,195	12–41	78.9	92.5	86.0	0.5	1.3	0.9										
Norway (2000)	Hagen [17]	Q	51,383	≥20	21.7	30.6	26.0													
Norway (2008)	Grande [18]	Q	20,598	30–44				0.8	2.1	1.6										
Croatia (2010)	Vukovic [19]	Q	1,542	≥18	19.1	23.2	21.2													
Italy (2001)	Prencipe [7]	PI	833	≥65	30.9 <sup>e</sup>	55.1 <sup>e</sup>	44.5 <sup>e</sup>			2.5 <sup>e</sup>								15.1 <sup>e</sup>		
Italy (2003)	Camarda [13]	PI	1,031	≥65	13.2 <sup>e</sup>	18.4 <sup>e</sup>	16.0 <sup>e</sup>													
Italy (2014)	[this study]	PI	904	≥18	18.4	20.1	19.4	0.5	0.6	0.6	8.8	10.6	9.8	9.1	8.9	9.0	2.0	2.6	2.3	
Turkey (2003)	Koseoglu [20]	PI	1,146	≥14		18.8				6.3								12.5		
Turkey (2012)	Ertas [4]	PI	5,323	18–65	5.7	4.5	5.1	0.4	0.04	0.2	1.8	1.3	1.6	3.4	3.1	3.3	10.1	8.8	9.5	
Georgia (2009)	Katsarava [21]	PI	1,145	≥16	6.8	12.0	10.0			3.3								8.8	18.5	27.3
Russia (2012)	Ayzenberg [22]	PI	2,025	18–65	27.7	29.1	25.4 <sup>b</sup>			3.4 <sup>c</sup>									7.7	
Jordan (2009)	Alzoubi [23]	Q	4,836	18–85	32.6	39.5	36.9													
Malaysia (1996)	Alders [24]	Q	595	>5	23.3	29.6	26.5			1.5										
Korea (1998)	Roh [25]	TI	2,500	≥15	17.8	14.7	16.2													
Korea (2012)	Kim [26]	Q	1,507	≥19	32.5	29.1	30.8													
Taiwan (2001)	Lu [27]	Q	3,377	≥15				1.2	1.6	1.4										
Japan (2004)	Takeshima [28]	Q	4,795	≥20	16.2	26.4	21.7	1.5	2.7	2.1										
China (2012)	Yu [29]	PI	5,041	18–65	7.7 <sup>e</sup>	14.0 <sup>e</sup>	10.8 <sup>e</sup>													
Chile (1998)	Lavados [30]	Q	1,385	≥15	18.1	35.2	26.9	1.1	3.9	2.6										
Brazil (2009)	Queiroz [31]	TI	3,848	18–79	9.5	15.4	11.9			0.8										
Ethiopia (2008)	Takele [32]	PI	1,105	25–77	5.4	15.8	9.4	0.4	3.5	1.6	2.5	7.1	4.3	2.5	5.2	3.5	0.3	0.5	0.4	



**Table 3** continued

Country (year)	First author (references)	Method	<i>n</i>	Age range (years)	Definite TTH <sup>a</sup>			Chronic TTH			Frequent episodic TTH			Infrequent episodic TTH			Probable TTH		
					M %	F %	Total %	M %	F %	Total %	M %	F %	Total %	M %	F %	Total %	M %	F %	Total %
Tanzania (2009)	Winkler [33]	PI	7,412	≥1	4.1	6.9	5.4	0.3	0.5	0.4							1.2	2.0	1.6

Results of the PACE study are reported in bold

PI personal interview, TI telephonic interview, Q questionnaire

<sup>a</sup> Definite TTH includes the episodic and chronic subtypes of TTH

<sup>b</sup> The value refers to cases of definite episodic TTH

<sup>c</sup> Definite and probable chronic TTH

<sup>d</sup> Probable episodic TTH

<sup>e</sup> The value refers to cases of definite and probable episodic TTH

dTTH prevalence at the lower limit of data ranges currently available for Western countries. It should be noted, however, that no reliable comparison is possible, due to the shortage of data currently available in the literature. We believe that it is crucial to conduct studies with comparable methodology to clarify the actual prevalence of this headache type.

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