



# Prevalence Rates of Primary Headache Disorders and Evaluation and Treatment Patterns Among Korean Neurologists

Byung-Kun Kim<sup>a</sup>

Min Kyung Chu<sup>b</sup>

Soo Jin Yu<sup>c</sup>

Grazia Dell'Agnello<sup>d</sup>

Hans-Peter Hundemer<sup>e</sup>

Tommaso Panni<sup>e</sup>

Sara Prada Alonso<sup>f</sup>

Sarah Louise Roche<sup>g</sup>

Jeong Hee Han<sup>c</sup>

Soo-Jin Cho<sup>h</sup>

<sup>a</sup>Department of Neurology,  
Nowon Eulji Medical Center,  
Eulji University School of Medicine,  
Seoul, Korea

<sup>b</sup>Department of Neurology,  
Severance Hospital,  
Yonsei University College of Medicine,  
Seoul, Korea

<sup>c</sup>Lilly Korea Ltd., Seoul, Korea

<sup>d</sup>Eli Lilly and Company,  
Sesto Fiorentino (FI), Italy

<sup>e</sup>Lilly Deutschland GmbH,  
Bad Homburg, Germany

<sup>f</sup>Clinipace, Madrid, Spain

<sup>g</sup>Eli Lilly and Company Cork, Ireland

<sup>h</sup>Department of Neurology,  
Dongtan Sacred Heart Hospital,  
Hallym University College of Medicine,  
Hwaseong, Korea

**Background and Purpose** Several studies have found that the prevalence of migraine is higher among healthcare professionals than in the general population. Furthermore, several investigations have suggested that the personal experiences of neurologists with migraine can influence their perception and treatment of the disease. This study assessed these relationships in Korea.

**Methods** A survey was used to investigate the following characteristics among neurologists: 1) the prevalence rates of migraine, primary stabbing headache, and cluster headache, and 2) their perceptions of migraine and the pain severity experienced by patients, diagnosing migraine, evaluation and treatment patterns, and satisfaction and difficulties with treatment.

**Results** The survey was completed by 442 actively practicing board-certified Korean neurologists. The self-reported lifetime prevalence rates of migraine, migraine with aura, primary stabbing headache, and cluster headache were 49.8%, 12.7%, 26.7%, and 1.4%, respectively. Few of the neurologists used a headache diary or validated scales with their patients, and approximately half were satisfied with the effectiveness of preventive medications. Significant differences were observed between neurologists who had and had not experienced migraine, regarding certain perceptions of migraine, but no differences were found between these groups in the evaluation and preventive treatment of migraine.

**Conclusions** The high self-reported lifetime prevalence rates of migraine and other primary headache disorders among Korean neurologists may indicate that these rates are underreported in the general population, although potential population biases must be considered. From the perspective of neurologists, there is an unmet need for the proper application of headache diaries, validated scales, and effective preventive treatments for patients. While the past experiences of neurologists with migraine might not influence how they evaluate or apply preventive treatments to migraine, they may influence certain perceptions of the disease.

**Keywords** Korea; neurologists; surveys; primary headache disorders; prevalence; disease management.

## INTRODUCTION

Primary headache disorders such as migraine, tension-type headache, cluster headache, and primary stabbing headache are caused by independent pathophysiological mechanisms and are not attributable to other disorders.<sup>1</sup> Headache disorders cause substantial disability worldwide and are thus a major global public health concern.<sup>2</sup> Migraine is a chronic neurological disease affecting 11.6% of the world's population.<sup>3</sup> The Global Burden of Disease Study 2017 estimated a global prevalence of 1.3 billion people.<sup>4</sup> Although tension-type headache is more prevalent than migraine, migraine causes more than six times the

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### Correspondence

Soo-Jin Cho, MD, PhD  
Department of Neurology,  
Dongtan Sacred Heart Hospital,  
Hallym University College of Medicine,  
7 Keunjaebong-gil,  
Hwaseong 18450, Korea

**Tel** +82-31-8086-2310

**Fax** +82-31-8086-2317

**E-mail** [dowonc@naver.com](mailto:dowonc@naver.com)

number of years lived with disability globally<sup>4</sup> and is the leading cause of disability in persons younger than 50 years.<sup>5,6</sup>

The estimated prevalence of migraine in the Asia-Pacific region is 9.1%.<sup>7</sup> In Korea, the estimated prevalence is reportedly around 8%–9% in females, 3% in males,<sup>8–10</sup> and 6% overall.<sup>7,10–12</sup> To our knowledge, the prevalence rates of primary stabbing headache and cluster headache have not been estimated in the general Korean population. Previous studies from the US, Europe, Australia, New Zealand, and Taiwan have shown that the prevalence of migraine is much higher among neurologists and headache specialists than in the general population.<sup>13–22</sup> The professional experience and knowledge in this group of healthcare professionals might make them better able to recall specific features of previous headaches and therefore be equipped to accurately diagnose migraine. It is therefore possible that the higher prevalence among neurologists and headache specialists could indicate that the prevalence is underestimated in the general population. Furthermore, studies from several countries have demonstrated both differences and similarities between neurologists with and without a personal history of migraine regarding their perception and treatment of migraine, and satisfaction with migraine treatments.<sup>14,17,18</sup> However, no comprehensive investigation has previously been conducted among Korean neurologists, which was therefore the focus of the current study.

We sought to determine the prevalence rates of migraine, primary stabbing headache, and cluster headache among Korean neurologists. In addition, we wanted to understand the diagnosis and clinical management of migraine in Korean patients from the perspective of neurologists, and determine if their perceptions of migraine and of diagnosing and treating their patients were influenced by whether or not they had previously experienced migraine themselves. To this end, a survey was designed for completion by Korean neurologists, and the findings are presented herein.

## METHODS

### Survey design and outcomes

Actively practicing board-certified neurologists who were members of the Korea Neurological Association were invited to participate in a computer-assisted web-based interview online survey created in collaboration with Hankook Research. Respondent population representativeness of the invited population was evaluated in terms of sex, age, and work setting. The survey took approximately 15 minutes to complete and included questions to assess the prevalence rates of migraine, primary stabbing headache, and cluster headache as well as the following characteristics related to their

experience of treating patients with migraine: perceptions of the disease and pain severity experienced by patients, diagnosing migraine using the International Classification of Headache Disorders,<sup>1</sup> evaluation and treatment patterns, and satisfaction and difficulties with treatment (Supplementary Material in the online-only Data Supplement). Surveys were completed between September 26 and November 13, 2019. Prevalence estimates were investigated by sex, with all other items investigated according to the personal experiences of neurologists with migraine.

### Ethics approval and consent to participate

Conducting surveys in Korea is exempt from the need to obtain ethics approval from the relevant Institutional Review Board (IRB), but approval is required to prepare a publication. Prior to participation, neurologists provided written consent to use the results of the survey for statistical purposes. Approval to prepare the manuscript was granted by the IRB of the Hallym University Dongtan Sacred Heart Hospital (IRB No. 2020-06-017). The anonymity of respondents was maintained throughout the study. The data were handled confidentially and are described in a de-identified manner.

### Statistical analyses

Categorical variables were reported using percentage and frequency values. Numerical variables were reported using the mean and either the standard deviation or standard error, as calculated using Microsoft Excel for Office 365. The unpaired *t*-test or one-way analysis of variance was used to compare continuous variables, and the chi-square test, Fisher-Freeman-Halton test, or Fisher's exact test were used to compare categorical variables. The significance cutoff was  $\alpha=0.05$ . Probability values were not adjusted due to the exploratory nature of the study. Statistical analyses were performed using SAS (version 9.4; SAS Institute, Cary, NC, USA).

## RESULTS

### Demographics of invited and respondent neurologists

The total number of board-certified neurologists in the Korea Neurological Association was 1,930 in 2019. Among them, 231 members were performing military duties, had been laid-off, or were retired. The remaining 1,699 actively practicing neurologists who were based throughout Korea were invited to participate in this study, of which 442 completed the survey (26% response rate). The demographic variables of the percentage of females, mean age, and work setting were generally similar among the respondent and invited neurologists (Table 1).

### Self-reported prevalence of several primary headache disorders among respondents

The self-reported prevalence rates of several primary headache disorders among the respondent neurologists are listed in Table 2, for males, females, and overall. The prevalence of experiencing a ‘headache yesterday’ among respondents was 15.4% overall and was higher among females than males. The lifetime prevalence of migraine was 49.8%, and higher among females (66.1%) than males (43.2%), and the prevalence of migraine with aura (migraine with aura only+both migraine with and without aura) was 12.7% among all respondents (4.3%+8.4%), and 25.4% among those with had experienced migraine (8.6%+16.8%). Overall, 26.7% and 1.4% of respondents had experienced primary stabbing headache and cluster headache, respectively, with similar prevalence rates among males and females. The reported 1-year prevalence rates of episodic migraine (EM) and chronic migraine (CM) were 43.2% and 0.2%, respectively (Table 2).

**Table 1.** Demographic variables of respondent neurologists and all neurologists invited to participate

Variable	Invited (n=1,699)	Respondents (n=422)
Sex, female	492 (29.0)	127 (28.7)
Age (yr)	43.2±7.8	41.9±7.2
Work setting		
Training hospital	765 (45.0)	227 (51.4)
Nontraining general hospital	495 (29.1)	122 (27.6)
Nursing hospital	161 (9.5)	28 (6.3)
Private clinic	278 (16.4)	65 (14.7)

Data are presented as mean±standard deviation or n (%).

**Table 2.** Self-reported prevalence of several primary headache disorders among respondents

Headache disorder	Males (n=315)	Females (n=127)	Overall (n=442)
Headache yesterday	39 (12.4)	29 (22.8)	68 (15.4)
Lifetime prevalence			
Migraine	136 (43.2)	84 (66.1)	220 (49.8)
Migraine with aura only	14 (10.3, 4.4*)	5 (6.0, 3.9*)	19 (8.6, 4.3*)
Migraine without aura only	100 (73.5, 31.7*)	64 (76.2, 50.4*)	164 (74.5, 37.1*)
Both migraine with and without aura	22 (16.2, 7.0*)	15 (17.9, 11.8)	37 (16.8, 8.4*)
Primary stabbing headache	86 (27.3)	32 (25.2)	118 (26.7)
Cluster headache	4 (1.3)	2 (1.6)	6 (1.4)
1-year prevalence			
Migraine	117 (37.1)	75 (59.1)	192 (43.4)
Migraine with aura only	6 (5.1, 1.9*)	2 (2.7, 1.6*)	8 (4.2, 1.8*)
Migraine without aura only	94 (80.3, 29.8*)	60 (80.0, 47.2*)	154 (80.2, 34.8*)
Both migraine with and without aura	17 (14.5, 5.4*)	13 (17.3, 10.2*)	30 (15.6, 6.8*)
Episodic migraine	116 (99.1, 36.8*)	75 (100.0, 59.1*)	191 (99.5, 43.2*)
Chronic migraine	1 (0.9, 0.3*)	0	1 (0.5, 0.2*)

Data are presented as n (%)

\*Percentage of entire group.

### Perceptions and evaluation of migraine

Most of the respondent neurologists considered migraine to be a major cause of disability (62.0%) and the most common brain disorder (69.5%), with these percentages being significantly higher among respondents who had experienced migraine (migraine in lifetime, corresponding to 49.8% [n=220] of the respondents) than among those who had not (no migraine in lifetime) (Table 3). Most respondents agreed that health policy authorities have a low interest in migraine (83.7%) and that fellow participants in patients’ social activities (e.g., at work and school) have a poor understanding of migraine pain (86.7%), with similar percentages in the ‘migraine in lifetime’ and ‘no migraine in lifetime’ groups for both items. The overall respondents had a high level of confidence in their ability to diagnose migraine in their patients (79.3%), with similar percentages in the ‘migraine in lifetime’ and ‘no migraine in lifetime’ groups (Table 3).

The mean score for the pain severity as perceived by the respondents in their patients was 6.6 for EM and 6.1 for CM, with no significant association between the mean score pain and having experienced migraine for either EM or CM (Table 3).

The rates of routinely using a headache diary (11.5%) and validated scales to assess headache-related disability and depression in their patients were overall very low (7.9% for Migraine Disability Assessment [MIDAS] or Headache Impact Test [HIT]-6, and 6.8% for Beck Depression Inventory [BDI] or Patient Health Questionnaire [PHQ]-9, respectively). No differences were found in the percentages for each of these items, although the numbers were higher in the ‘migraine in lifetime’ compared with the ‘no migraine in lifetime’ group.

**Table 3.** Perceptions and evaluations of migraine

Variable	Migraine in lifetime	No migraine in lifetime	Overall	<i>p</i>
Number of respondents	220	222	442	
Answered 'Agree' <sup>††</sup>				
Migraine is a major cause of disability	148 (67.3)	126 (56.8)	274 (62.0)	0.0228*
Migraine is the most common brain disorder	163 (74.1)	144 (64.9)	307 (69.5)	0.0352*
Health policy authorities have a low interest in migraine	183 (83.2)	187 (84.2)	370 (83.7)	0.7645
Fellow participants in patients' social activities (e.g., at work and school) have a poor understanding of migraine pain	194 (88.2)	189 (85.1)	383 (86.7)	0.3464
Confidence in diagnosing migraine (%)	79.1±0.8	79.6±0.7	79.3±0.5	0.6608
Pain severity among patients (scale from 0 to 10)				
EM	6.5±0.1	6.6±0.1	6.6±0.1	0.3898
CM	6.0±0.1	6.1±0.1	6.1±0.1	0.1884
Routine use <sup>†</sup>				
Headache diary	31 (14.1)	20 (9.0)	51 (11.5)	0.0945
MIDAS or HIT-6	22 (10.0)	13 (5.9)	35 (7.9)	0.1067
BDI or PHQ-9	19 (8.6)	11 (5.0)	30 (6.8)	0.1239
Number of respondents	189	202	391	
Lack of time per consultation as a reason for not using a headache diary	111 (58.7)	102 (50.5)	213 (54.5)	0.1022
Low compliance of patients as a reason for not using a headache diary	56 (29.6)	84 (41.6)	140 (35.8)	0.0137*
Number of respondents	198	209	407	
Lack of time per consultation as a reason for not using MIDAS or HIT-6	141 (71.2)	126 (60.3)	267 (65.6)	0.0204*
Number of respondents	201	211	412	
Lack of time per consultation as a reason for not using BDI or PHQ-9	145 (72.1)	130 (61.6)	275 (66.7)	0.0234*

Data are presented as mean±SE or *n* (%).

\*Statistically significant difference between the 'migraine in lifetime' and 'no migraine in lifetime' groups; <sup>†</sup>Percentage of respondents who answered 'strongly agree' or 'agree' (other possible answers were 'neutral', 'disagree', and 'strongly disagree'); <sup>††</sup>Percentage of respondents who answered 'use for most patients' (other possible answers were 'use it for some patients' and 'do not use it'). Pain severity was scored on a numerical rating scale from 0 to 10, with 10 representing the most-severe pain. The 'migraine in lifetime' group was compared with the 'no migraine in lifetime' group using a two-way chi-square test for all analyses except for pain severity and confidence in diagnosing migraine, for which an unpaired two-tailed *t*-test was used.

BDI, Beck Depression Inventory; CM, chronic migraine; EM, episodic migraine; HIT, Headache Impact Test; MIDAS, Migraine Disability Assessment; PHQ, Patient Health Questionnaire; SE, standard error.

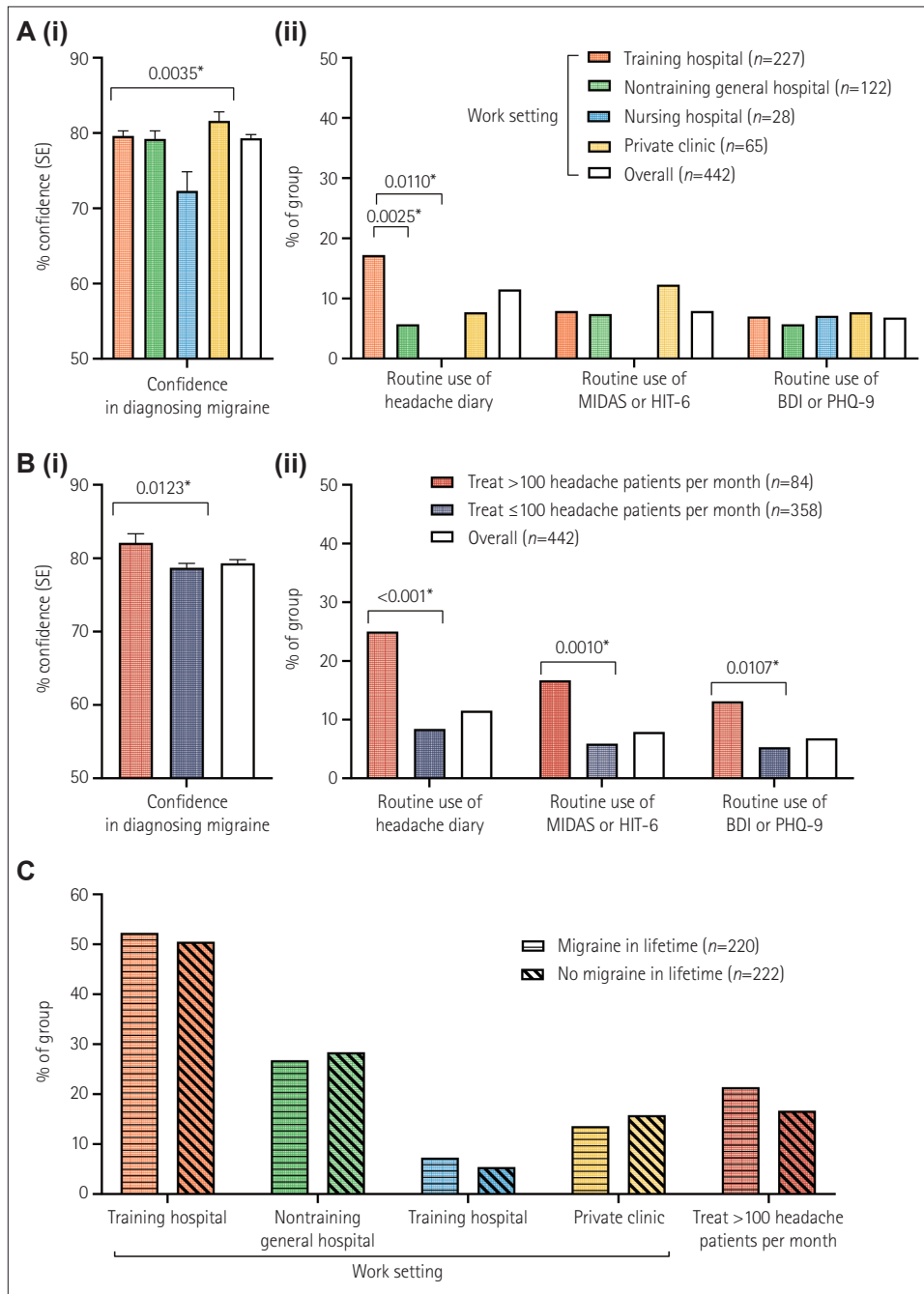
A lack of time per consultation as a reason for not using a headache diary, MIDAS or HIT-6, and BDI or PHQ-9 with their patients was reported by 54.5%, 65.6%, and 66.7% of respondents, respectively, with significantly higher percentages in the 'migraine in lifetime' group than in the 'no migraine in lifetime' group for the scales only. Low compliance of patients as a reason for not using a headache diary with their patients was reported by 35.8% of respondents, with the percentage being significantly lower in the 'migraine in lifetime' group than in the 'no migraine in lifetime' group (Table 3).

Since the work setting—which could affect the clinical habits of neurologists—could be a determining factor in the use of such tools, we compared these results between respondents grouped by work setting: training hospital (*n*=227), nontraining general hospital (*n*=122), nursing hospital (*n*=28), and private clinic (*n*=65). This revealed a significant association between work setting and confi-

dence in diagnosing migraine (Fig. 1A(i)), as well as significant differences between certain work settings for the routine use of a headache diary (Fig. 1A(ii)). When the results were grouped by neurologists who treat averages of >100 (*n*=84) or ≤100 (*n*=358) headache patients per month, the confidence in diagnosing migraine along with the routine use of headache diary, MIDAS or HIT-6, and BDI or PHQ-9 were all significantly higher among neurologists who treat >100 headache patients per month (Fig. 1B(i) and (ii)). The percentages of respondents by work setting and according to >100 headache patients per month did not differ significantly between the 'migraine in lifetime' group and the 'no migraine in lifetime' group (Fig. 1C).

### Number of headache patients and preventive treatment patterns for migraine

The mean number of headache patients in the previous month was 101.0 overall, 110.3 in the 'migraine in lifetime' group,



**Fig. 1.** Work characteristics of respondents. A: Results for (i) confidence in diagnosing migraine, and the (ii) routine use of a headache diary, Migraine Disability Assessment (MIDAS) or Headache Impact Test (HIT)-6, and Beck Depression Inventory (BDI) or Patient Health Questionnaire (PHQ)-9: (percentage of respondents who answered 'use for most patients' [other possible answers were 'use it for some patients' and 'do not use it']) according to the work setting. Work settings were compared using one-way analysis of variance for the confidence in diagnosing migraine, and Fisher's exact two-sided test in each possible two-group comparison for all other analyses. \*Statistically significant for comparisons of work settings. B: Results for (i) confidence in diagnosing migraine, and the (ii) routine use of a headache diary, MIDAS or HIT-6, and BDI or PHQ-9: (percentage of respondents who answered 'use for most patients' [other possible answers were 'use it for some patients' and 'do not use it']) by neurologists who treat either >100 or ≤100 headache patients per month. The 'treat >100 headache patients per month' group was compared with the 'treat ≤100 headache patients per month' group using an unpaired *t*-test to assess the confidence in diagnosing migraine, while a two-way chi-square test was used for all other analyses. \*Statistically significant for the comparison between the 'treat >100 headache patients per month' and 'treat ≤100 headache patients per month' groups. C: Percentages of respondent neurologists working in training hospitals, nontraining general hospitals, nursing hospitals, and private clinics are shown, along with percentages of neurologists who treat >100 headache patients per month in the 'migraine in lifetime' and 'no migraine in lifetime' groups. The 'migraine in lifetime' group was compared with the 'no migraine in lifetime' group using a two-way chi-square test for all analyses. SE, standard error.

**Table 4.** Number of headache patients and preventive treatment patterns for migraine

Variable	Migraine in lifetime (n=220)	No migraine in lifetime (n=222)	Overall (n=442)	p
Number of headache patients in the previous month	110.3±8.9	91.7±5.8	101.0±5.3	0.0803
Minimum number of headache days per month for which preventive medication would be prescribed*				0.4078
1-3	21 (9.5)	25 (11.3)	46 (10.4)	
4-7	70 (31.8)	83 (37.4)	153 (34.6)	
8-14	97 (44.1)	81 (36.5)	178 (40.3)	
15-31	32 (14.5)	33 (14.9)	65 (14.7)	
First-line preventive treatment for EM				0.1155
Propranolol	113 (51.4)	122 (55.0)	235 (53.2)	
Amitriptyline	40 (18.2)	29 (13.1)	69 (15.6)	
Topiramate	38 (17.3)	29 (13.1)	67 (15.2)	
Flunarizine	27 (12.3)	33 (14.9)	60 (13.6)	
Divalproex	2 (0.9)	8 (3.6)	10 (2.3)	
Botox	0	1 (0.5)	1 (0.2)	
First-line preventive treatment for CM†				0.1462
Topiramate	80 (36.4)	62 (27.9)	142 (32.1)	
Propranolol	61 (27.7)	78 (35.1)	139 (31.4)	
Amitriptyline	39 (17.7)	32 (14.4)	71 (16.1)	
Flunarizine	22 (10.0)	24 (10.8)	46 (10.4)	
Divalproex	9 (4.1)	18 (8.1)	27 (6.1)	
Botox	9 (4.1)	8 (3.6)	17 (3.8)	
Target goal for duration of preventive treatment (mo)	5.2±0.2	5.3±0.3	5.2±0.2	0.7335

Data are presented as mean±SE or n (%).

\*This question was based on the minimum (rather than the actual) number of headache days per month. For example, for a patient with 31 headache days per month, 100% (9.5%+31.8%+44.1%+14.5%) of respondent neurologists would prescribe them preventive medication; †Note that the first calcitonin-gene-related peptide monoclonal antibody for preventive treatment of migraine was approved in Korea during September 2019, which was not available for use until December 2019, when the survey had already finished. The 'migraine in lifetime' group was compared with the 'no migraine in lifetime' group using an unpaired two-tailed t-test for the number of headache patients in the previous month and the target goal for the duration of preventive treatment, a Freeman-Halton test was used for first-line treatment for EM, and a two-way chi-square test was used for the minimum number of headache days per month and first-line treatment for CM. CM, chronic migraine; EM, episodic migraine; SE, standard error.

and 91.7 in the 'no migraine in lifetime' group (Table 4). Preventive medication was prescribed to 24.8 (54.4%) of the average of 45.6 migraine patients during the previous month per respondent (data not presented in Table 4). The distribution of minimum monthly headache days for prescribing preventive medication did not differ significantly between the 'migraine in lifetime' and the 'no migraine in lifetime' groups (Table 4). Overall, the most commonly prescribed first-line preventive treatment for patients with EM was propranolol (53.2%), followed by amitriptyline (15.6%), and for CM it was topiramate (32.1%), followed closely by propranolol (31.4%), although in the 'no migraine in lifetime' group, the first-line preventive treatment for CM was propranolol followed by topiramate (Table 4). The target goal among respondents for the mean duration of preventive treatment in their patients was 5.2 months (Table 4).

### Satisfaction and difficulties associated with treating migraine

The percentage of respondents satisfied with triptans as an acute treatment for their patients was 69.9%, and 49.8% were satisfied with the effectiveness of preventive medication (Table 5). The main specific reason for respondents experiencing difficulties in treating their patients was controlling for lifestyle factors (33.9%), followed by low compliance with medication (28.7%), low effectiveness of medication (21.7%), and adverse effects of preventive medication (15.2%). There was a significant association between the group variable related to previous experience with migraine and the reason for difficulties in treating migraine categories (Table 5).

## DISCUSSION

This survey estimated that the self-reported 1-year migraine

**Table 5.** Satisfaction and difficulties associated with treating migraine patients according to the experience of migraine

Variable	Migraine in lifetime (n=220)	No migraine in lifetime (n=222)	Overall (n=442)	p
Satisfied with triptans as an acute treatment*	155 (70.5)	154 (69.4)	309 (69.9)	0.8036
Satisfied with effectiveness of preventive medication†	109 (49.5)	111 (50.0)	220 (49.8)	0.9239
Main specific reason for difficulties in treating migraine				0.0389†
Controlling for lifestyle factors	75 (34.1)	75 (33.8)	150 (33.9)	
Low compliance with medication	72 (32.7)	55 (24.8)	127 (28.7)	
Low effectiveness of medication	36 (16.4)	60 (27.0)	96 (21.7)	
Adverse effects of preventive medication	35 (15.9)	32 (14.4)	67 (15.2)	

Data are presented as n (%).

\*Percentage of respondents who answered 'very satisfied' or 'satisfied' (other possible answers were 'neutral', 'not satisfied', and 'not at all satisfied');

†Percentage of respondents who answered 'strongly agree' or 'agree' (other possible answers were 'neutral', 'disagree', and 'strongly disagree'). The 'migraine in lifetime' group was compared with the 'no migraine in lifetime' group using a two-way chi-square test; †Statistically significant difference between the 'migraine in lifetime' and 'no migraine in lifetime' groups.

prevalence was 43.4% among Korean neurologists, and higher among females than males, as expected.<sup>7,10,11</sup> Most recent estimates of the 1-year prevalence of migraine in the Korean general population have been around 6.0%, which is lower than in Western countries but similar to other Asian countries.<sup>7,10-12</sup> There are several possible underlying causes for this huge difference in prevalence estimates. The professional experience of neurologists might make them better able to recall specific features of previous headaches that fall within the remit of a definitive diagnosis of migraine. In population-based studies, the actual prevalence could be underestimated due to a lack of information on the migraine history of individuals, or possible mislabeling as other types of headaches. In addition, the early use of pain medications prior to the occurrence of the typical symptoms of migraine may result in characteristics that no longer fulfill the diagnostic criteria of migraine. It is particularly interesting that the cumulative incidence of migraine has been estimated as being 2.5–3 times higher than estimates of 1-year prevalence in the general US population.<sup>23</sup> It is worth noting that recent prevalence estimates in the general Korean population applied criteria of the International Classification of Headache Disorders-2,<sup>10,11</sup> and estimated the 1-year prevalence of probable migraine at 11.5%.<sup>11</sup> Self-diagnosis of migraine among neurologists may include probable migraine. Along with neurologists being able to self-diagnose, this may lead to over-reporting among neurologists.

Surveys of neurologists in Germany,<sup>17</sup> Norway,<sup>13</sup> Australia and New Zealand,<sup>20</sup> and the US<sup>15</sup> found that personal experiences with headache/migraine influenced the decision to become a neurologist in 8%, <1%, 2.2%, and 8% (males)/9% (females) of cases, respectively. Thus, a higher prevalence of migraine among neurologists compared with the general population might be an artifact of an influenced career choice. Another possible reason for an increased prevalence of mi-

graine among neurologists is a higher risk of developing migraine due to exposure to occupational factors such as stress, which merits further study.<sup>24</sup>

Among the neurologists who had experienced migraine, the lifetime prevalence of migraine with aura was 25.4%, which is higher than previous prevalence estimates of 13% and 20% in Korean patients with migraine.<sup>25,26</sup> The second most common type of primary headache disorders among the respondent neurologists was primary stabbing headache, which supports previous findings for a Korean headache clinic, although there was a marked difference in their prevalence estimates (26.7% and 11.0%, respectively).<sup>27</sup> Prevalence estimates of primary stabbing headache in the general populations of other countries range from 2% to 35%.<sup>28-30</sup> Overall, 1.4% of respondents reported having experienced cluster headache, which is much higher than the estimated lifetime prevalence of 0.1% in the general population based on a meta-analysis of epidemiological studies from around the world.<sup>31</sup> These differences might reflect underdiagnosis of primary stabbing headache and cluster headache in the general Korean population or a favorable natural history. However, the occurrence of underdiagnosis cannot be confirmed since, to our knowledge, the prevalence rates of primary stabbing headache and cluster headache have not been estimated in the general Korean population.

Significant differences between the 'migraine in lifetime' and 'no migraine in lifetime' groups regarding the perception of migraine as a disorder could be indicative of an overall lack of awareness among the general population of the burden of migraine. Low rates of routinely using a headache diary and validated scales with their patients could be associated with a lack of time per consultation, low compliance of patients, or a high confidence in performing accurate diagnoses without using scales. The use of such instruments plays an important role in accurate diagnosis and measuring

the impact and success of treatment.<sup>32,33</sup> Results grouped by work setting and the number of headache patients that they treated per month implicate these factors in the level of confidence in diagnosing migraine and using certain tools. However, these results should be interpreted with caution since the number of respondents in each work setting group ranged from 28 to 227, and in the categories of >100 and ≤100 headache patients per month were 84 and 358, respectively, thus potentially introducing bias.

Investigating the minimum number of ‘migraine headache days’ rather than the number of ‘headache days’ per month for which preventive medication would be prescribed was not possible due to the nonavailability of data. The top-three first-line preventive treatments prescribed (propranolol, amitriptyline, and topiramate) and the target goal for preventive treatment duration were consistent with American Headache Society/American Academy of Neurology and national Korean guidelines.<sup>34,35</sup> There are many options available in Korea for the acute treatment of migraine, but triptans are the most commonly used prescription drug in this class. The difference between the rates of satisfaction with triptans (69.9%) and preventive treatment effectiveness (49.8%) could be due to perceived efficacy and tolerability of the respective treatments, and is closely aligned with the reported difference between satisfaction with acute and prophylactic headache treatments among French neurologists.<sup>14</sup> This result is also in line with a survey of neurologists and headache patients across eight Asian countries, including Korea, which found that 59.6% of neurologists were satisfied with the relief obtained by their patients within 2 hours of taking acute-pain medication.<sup>36</sup>

Similar percentages of neurologists who had and had not experienced migraine reported that controlling for lifestyle factors was the main reason for difficulties in treating migraine, a topic of major current interest in the field, particularly for lifestyle factors.<sup>37,38</sup> There was more reporting of low compliance with medication and less reporting of low effectiveness of medication among neurologists who had experienced migraine. This could be explained by a better understanding of the importance of compliance with medication as well as greater appreciation for even low levels of effectiveness among neurologists with a personal history of migraine.

The results of this survey were unlikely to be biased by demographic characteristics of the respondents, since the demographic variables of the percentage of females, mean age, and work setting were generally similar in the respondent and invited neurologists. As discussed above, the high prevalence of migraine could be an artifact of an influenced career choice or be attributable to occupational exposure, which should be considered as possible types of population bias.

Neurologists with an interest in the headache field for reasons such as a personal or family history of migraine may have been more likely to respond to the survey. This could have introduced participation bias that increased the prevalence of migraine among the respondent neurologists. Regarding our findings on prevalence rates, the reader should also consider the differences in methodologies between our study and previous studies of estimated prevalence, in particular the setting and group (e.g., population-based, headache clinic, or neurologists). Another possible limitation of the study is the short time frame in which the surveys were completed, which may have reduced the number of respondents.

In summary, the self-reported prevalence rates of migraine, primary stabbing headache, and cluster headache were higher among Korean neurologists than the rates estimated in general population-based studies from Korea and other countries, which is in line with the findings of several previous studies from other countries that have investigated the prevalence of migraine among healthcare professionals. There may be a need to provide more medical education on the advantages of using a headache diary and validated tools in the diagnosis and clinical management of patients with migraine. Low satisfaction among neurologists with the effectiveness of preventive medication highlights the unmet need for more effective treatments for this disorder. The present results suggest that while the past experiences of neurologists with migraine do not influence how they evaluate or preventively treat migraine, they do influence certain perceptions of migraine as a disease.

### Supplementary Materials

The online-only Data Supplement is available with this article at <https://doi.org/10.3988/jcn.2022.18.5.571>.

### Availability of Data and Material

The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

### ORCID iDs

Byung-Kun Kim	<a href="https://orcid.org/0000-0003-1053-4682">https://orcid.org/0000-0003-1053-4682</a>
Min Kyung Chu	<a href="https://orcid.org/0000-0001-6221-1346">https://orcid.org/0000-0001-6221-1346</a>
Soo Jin Yu	<a href="https://orcid.org/0000-0002-5567-1923">https://orcid.org/0000-0002-5567-1923</a>
Grazia Dell’Agnello	<a href="https://orcid.org/0000-0002-5482-6065">https://orcid.org/0000-0002-5482-6065</a>
Hans-Peter Hundemer	<a href="https://orcid.org/0000-0002-6341-1152">https://orcid.org/0000-0002-6341-1152</a>
Tommaso Panni	<a href="https://orcid.org/0000-0002-1208-9490">https://orcid.org/0000-0002-1208-9490</a>
Sara Prada Alonso	<a href="https://orcid.org/0000-0003-2349-2784">https://orcid.org/0000-0003-2349-2784</a>
Sarah Louise Roche	<a href="https://orcid.org/0000-0001-5709-8959">https://orcid.org/0000-0001-5709-8959</a>
Jeong Hee Han	<a href="https://orcid.org/0000-0002-3912-3003">https://orcid.org/0000-0002-3912-3003</a>
Soo-Jin Cho	<a href="https://orcid.org/0000-0002-4053-3763">https://orcid.org/0000-0002-4053-3763</a>

### Author Contributions

Conceptualization: Byung-Kun Kim, Min Kyung Chu, Soo Jin Yu, Soo-Jin Cho. Data curation: Byung-Kun Kim, Min Kyung Chu, Soo-Jin Cho, Soo Jin Yu, Tommaso Panni, Sara Prada Alonso, Sarah Louise Roche. Formal



analysis: Soo Jin Yu, Tommaso Panni, Sara Prada Alonso, Sarah Louise Roche. Funding acquisition: Byung-Kun Kim, Jeong Hee Han. Investigation: Byung-Kun Kim, Min Kyung Chu, Soo Jin Yu, Soo-Jin Cho. Methodology: Byung-Kun Kim, Min Kyung Chu, Soo Jin Yu, Tommaso Panni, Sara Prada Alonso, Soo-Jin Cho. Project administration: all authors. Resources: Byung-Kun Kim, Min Kyung Chu, Soo Jin Yu, Soo-Jin Cho. Supervision: Soo Jin Yu, Grazia Dell'Agnello, Hans-Peter Hundemer, Tommaso Panni, Sara Prada Alonso, Sarah Louise Roche, Jeong Hee Han. Validation: Tommaso Panni, Sara Prada Alonso. Visualization: Sarah Louise Roche. Writing—original draft: Byung-Kun Kim, Sarah Louise Roche. Writing—review & editing: all authors.

### Conflicts of Interest

Byung-Kun Kim reports the following in relation to the past 36 months: Grants/contracts with Korea Neurological Association and Y-Brain; Consulting fees from Sanofi Korea and Novartis; Payment/honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from GSK Korea, Lilly Korea, Lundbeck Korea, SK Pharm, Ildong Pharm; Support for attending meetings and/or travel from Teva, Eli Lilly and Company, and Novartis; and Participation on a Data Safety Monitoring Board or Advisory Board with National Pension Service. Min Kyung Chu reports the following in relation to the past 36 months: Site investigator for a multi-center trial sponsored by Otsuka Korea, Novartis, International AG, and Eli Lilly and Company; Advisory member for Teva; Lecture honoraria from Allergan Korea, Handok-Teva, and Yuyu Pharmaceutical Company; Grants from the Yonsei University College of Medicine (2018-32-0037) and National Research Foundation of Korea (2019R1F1A1053841). Soo Jin Yu and Sarah Louise Roche are full-time employees of Eli Lilly and Company. Grazia Dell'Agnello and Jeong Hee Han are full-time employees and minor shareholders of Eli Lilly and Company. Hans-Peter Hundemer, now retired from Eli Lilly and Company, was a full-time employee and a minor shareholder of Eli Lilly and Company during preparation of the manuscript. Tommaso Panni is a full-time employee of Eli Lilly and Company for the last 32 months. Previously, Tommaso Panni was a full-time employee at Advanced Medical Services. Sara Prada Alonso is a permanent, full-time employee of Clinipace. Soo-Jin Cho reports the following in relation the past 36 months; Payment/honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Allergan Korea, WhanIn Pharm Co., Ltd., Shinpoong Pharma. Co., Ltd., and SK chemicals; Presidency of Korea Headache Society; Site investigator of a multicenter trial sponsored by Otsuka Korea, Allergan, Ildong Pharmaceutical Co., Ltd., Novartis International AG, Eli Lilly and Company, Hyundaiapharm. Co. Ltd., Biohaven Asia Pacific Ltd., H. Lundbeck A/S (Lundbeck), and Parexel Korea Co., Ltd.

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