Chronic Daily Headache in Korea: Prevalence, Clinical Characteristics, Medical Consultation and Management

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Background and Purpose Chronic daily headache (CDH) is a commonly reported reason for visiting hospital neurology departments, but its prevalence, clinical characteristics, and management have not been well documented in Korea. The objective of this study was to characterize the 1-year prevalence, clinical characteristics, medical consultations, and treatment for CDH in Korea.

Methods The Korean Headache Survey (KHS) is a nationwide descriptive survey of 1507 Korean adults aged between 19 and 69 years. The KHS investigated headache characteristics, sociodemographics, and headache-related disability using a structured interview. We used the KHS data for this study.

Results The 1-year prevalence of CDH was 1.8% (95% confidence interval, 1.1–2.5%), and 25.7% of the subjects with CDH met the criteria for medication overuse. Two-thirds (66.7%) of CDH subjects were classified as having chronic migraine, and approximately half of the CDH subjects (48.1%) reported that their headaches either substantially or severely affected their quality of life. Less than half (40.7%) of the subjects with CDH reported having consulted a doctor for their headaches and 40.7% had not received treatment for their headaches during the previous year.

Conclusions The prevalence of CDH was 1.8% and medication overuse was associated with one-quarter of CDH cases in Korea. Many subjects with CDH do not seek medical consultation and do not receive appropriate treatment for their headaches.

Key Words chronic daily headache, chronic migraine, epidemiology, headache, migraine.

Introduction Chronic daily headache (CDH) is a categorization applied to various types of headache disorder that occur more than 15 days per month for longer than 3 months. Approximately 10% of patients with headaches seen in general neurology clinics meet the CDH criteria.1,2 CDH is usually associated with a profound decline in quality of life. In spite of recent advances in our understanding of the pathophysiology and treatment of CDH, a considerable proportion of patients with this condition are underdiagnosed and undertreated.3,4 Most individuals with primary CDH report headaches with migrainous features.2,4-7 The close association between migraine and CDH has prompted proposals for the chronic migraine (CM) criteria.8-10 Although CDH is a common problem in clinical practice, no population-based data on CDH have yet been reported in Korea. In the present study we estimated the 1-year prevalence of CDH in a Korean population using the Korean Headache Survey (KHS) data.11 We also investigated the clinical characteristics and the incidence of seeking medical consultation and treat-
ment for CDH.

Methods

Korean Headache Survey was a nationwide, cross-sectional, descriptive survey conducted on headache disorders in 1507 participants sampled from the Korean general population aged between 19 and 69 years. Semistructured interviews were performed with the aid of a questionnaire to investigate the status of headache disorders. The survey reported on the symptoms, impact on quality of life, and management of headache disorders. This study was performed in March 2009 in accordance with the ethical guidelines of the Council for International Organizations of Medical Sciences and the principles of the Declaration of Helsinki. Detailed information on the KHS process is available elsewhere.

Sample

According to the 2005 population and housing census conducted by the National Statistical Office, the estimated population of individuals aged 19–69 years in Korea in 2009 was 37782000. The present study included all Korean territories (with the exception of Jeju-do) and classified residential areas into large city, medium-to-small city, and rural area according to the degree of urbanization (Table 1). Our sample targeted 1500 individuals and the selection process was based on the Korean population structure. We adopted a two-stage systematic clustered random sampling method. The 15 administrative divisions were designated as the primary sampling units. In each of the 15 administrative divisions, 4 representative basic units were randomly selected as secondary sampling units. The survey was therefore applied in 60 representative basic units where appropriate assessments of residential status, population structure, household income, and occupational structure were available. In each sampling unit, the target sample number was determined based on the distributions of sociodemographic parameters such as age, gender, educational level, and monthly household income. Interviewers recruited participants who met the assigned sociodemographic characteristics by door-to-door visits. The estimated sampling error of the KHS was ±2.5% with a 95% confidence interval (CI). Weighted values were assigned to each subject according to the distribution of the Korean population in order to estimate the adjusted prevalence. The representativeness of our sample was assessed by comparing sociodemographic distributions between our samples and the total Korean population by using data from the Korean National Statistical Office.

Questionnaire

The questionnaire was designed to assess demographic and socioeconomic characteristics (9 questions), headache profiles according to the second edition of the International Classification of Headache Disorders, headache profiles

| Table 1. Sociodemographic distribution of all survey participants, the total Korean population, and of cases identified as having chronic daily headache (CDH) |
|---------------------------------------------------------------|
| **Gender** | Sample, n (%) | Total population, n (%) | p | CDH, n | Crude prevalence, % (95% CI) | Adjusted prevalence, % (95% CI) | p |
|---------------------------|----------------|--------------------------|---|--------|-----------------------------|--------------------------------|---|
| **Men** | 755 (49.4) | 17584365 (50.6) | 0.78 | 12 | 1.6 (0.7–2.5) | 1.0 (0.6–2.3) | 0.28 |
| **Women** | 752 (50.6) | 17198350 (49.4) | 15 | 2.0 (1.0–3.0) | 2.3 (1.2–3.3) | 1.0 |
| **Age group (years)** | | | | | | | |
| 19–29 | 241 (22.8) | 7717947 (22.2) | 0.99 | 4 | 1.7 (0.4–3.3) | 1.8 (0.4–3.3) | 1.1 |
| 30–39 | 340 (23.5) | 8349487 (24.0) | 4 | 1.2 (0.2–2.3) | 1.1 (0.2–2.2) | 1.0 |
| 40–49 | 418 (23.0) | 8613110 (24.8) | 5 | 1.2 (0.1–2.2) | 1.3 (0.8–2.4) | 1.0 |
| 50–59 | 324 (19.8) | 6167505 (17.7) | 7 | 2.2 (0.6–3.8) | 2.1 (0.5–3.8) | 1.0 |
| 60–69 | 184 (10.8) | 3934666 (11.3) | 7 | 3.8 (1.0–6.6) | 4.1 (1.0–7.1) | 1.0 |
| **Residential area** | | | | | | | |
| Large city | 704 (46.7) | 1677671 (48.2) | 0.89 | 13 | 1.8 (0.8–2.8) | 2.0 (1.0–3.0) | 0.54 |
| Medium-to-small city | 658 (43.7) | 15164345 (43.6) | 10 | 1.5 (0.6–2.5) | 1.5 (0.6–2.4) | 1.0 |
| Rural area | 145 (9.6) | 2841599 (8.2) | 4 | 2.8 (0.6–5.5) | 3.0 (0.7–5.7) | 1.0 |
| **Educational level** | | | | | | | |
| Middle school or less | 240 (15.9) | 6291149 (19.0) | 0.57 | 8 | 3.3 (1.0–5.6) | 3.5 (1.1–5.9) | 0.09 |
| High school or more | 1267 (84.0) | 26861726 (81.0) | 19 | 1.5 (0.6–2.5) | 1.6 (0.6–2.5) | 1.0 |
| **Total** | 1507 (100.0) | 7717947 (22.2) | 27 | 1.8 (1.2–2.5) | 1.8 (1.2–2.5) | 1.0 |

*Adjusted prevalence with weighted value. †Comparison of distributions of gender, age group, size of residential area, and educational level between the sample of the present study and the total population of Korea. ‡Comparison of adjusted CDH prevalence among the different *genders, †age groups, ‡sizes of residential area, and §educational levels. CI: confidence interval.
tion of Headache Disorders (ICHD, ICHD-2; 21 questions), and headache management plans (8 questions). We included the six-question Headache Impact Test (HIT-6) questionnaire to evaluate the impact of headache on quality of life.\(^\text{16}\) The questionnaire was validated for migraine (75.0% sensitivity and 88.2% specificity) and tension-type headache (86.2% sensitivity and 75.5% specificity) diagnoses by comparing the doctors’ diagnoses in an additional telephone interview and the diagnoses in the survey. The additional telephone interview was applied to 135 subjects who consented to it.\(^\text{11}\)

Survey procedures
Subjects were stratified according to age, gender, and occupation. Prior to meeting the subjects, the interviewers were provided with the following information: 1) the aims of the present study, 2) the meaning of each question, 3) instructions for interpreting the subjects’ responses, and 4) other details that were relevant to conducting a proper interview. All interviewers were employed by Gallup Korea and had previous social-survey interviewing experience. The interviewers were not medical personnel. The survey was conducted by door-to-door visits and face-to-face interviews.

Case definition of CDH
If a subject responded positively to the statement “In the past year, you had at least one headache lasting more than 1 min,” and the subject’s headache presented ≥15 days per month for more than 3 months, he/she was classified as having CDH.

Case definition of CM
In the present study, we used the modified CM criteria outlined in the new appendix criteria for a broader concept of CM, which provides more inclusive criteria for the diagnosis of CM.\(^\text{9}\) A diagnosis of CM was assigned if a CDH subject’s headaches met the ICHD-2 criteria for migraine or probable migraine (PM). A diagnosis of PM was based on the assigned A–D criteria for migraine without aura (code 1.1) in the third edition of the ICHD (beta version). If a participant’s response met all criteria except one, he/she was identified as having PM.\(^\text{10}\)

Case definition of medication overuse
A diagnosis of medication overuse (MO) was based on the new appendix criteria for a broader concept of CM.\(^\text{5}\) A participant with CDH was diagnosed with MO if he/she reported regularly overusing acute/symptomatic treatment drugs that were defined in either criterion 1 or 2 for more than 3 months (criterion 1: ergotamine, triptans, opioids, or a combination of analgesics, triptans, or analgesic opioids ≥10 days/month for >3 months; criterion 2: simple analgesics or any combination of ergotamine, triptans, or analgesic opioids ≥15 days/month without the overuse of any single class alone).

Impact of headache
We included the Korean version of the HIT-6 questionnaire in order to assess the impact of headaches on quality of life.\(^\text{17}\) The HIT-6 score was used to assign the subjects to an impact grade as follows: 36–49, little-to-no impact; 50–55, some impact; 56–59, substantial impact; or 60–78, severe impact.\(^\text{16}\)

Medical consultations and treatment for CDH
We examined the medical consultations and treatment that the subjects received. To assess medical consultations, we used the question “Have you ever visited a medical doctor for your headaches?” If a subject replied “yes”, he/she was classified as having sought a medical consultation for his/her headaches.

The treatment of CDH was assessed by asking the question, “How did you treat your headaches over the past year?” This allowed the interviewer to distinguish between different treatment strategies such as 1) medical treatment, 2) over-the-counter (OTC) medications, 3) oriental medicine, 4) alternative methods other than oriental medicine, and 5) no treatment. If a subject treated his/her headaches with a medicine, an additional question was asked to evaluate the medical treatment regimen.

Analyses
The 1-year prevalence with a 95% CI was calculated for each diagnosis, after adjustment of weighted values. Age- and gender-specific prevalence rates of CDH were also calculated using a 95% CI. The results were analyzed with statistical software for R (version 2.14.1) and R commander (version 1.7–3) (The R Foundation, GNU general public license). The Kolmogorov-Smirnov test was applied to test whether the continuous variables were normally distributed. After a normal distribution was confirmed, Student’s t-tests, Mann-Whitney U tests, and chi-square tests were used for comparisons, as appropriate. Except where stated otherwise, the data are presented as mean±SD values, and the cutoff for statistical significance was set at \(p<0.05\).

Results
Sample
Of the 4054 individuals approached by our 76 interviewers, 1699 agreed to participate in the survey. Of these, 192 individuals suspended the interview, so that ultimately 1507 subjects completed the survey (cooperation rate of 37.2%) (Fig. 1). The distributions of age, gender, size of residential area, and educational level across our samples did not differ significantly from those for the total Korean population (Table 1).
Prevalence, clinical characteristics, and impact of CDH

Of the 1507 subjects interviewed, 27 patients were classified as having CDH (1.8% of total cases; 95% CI, 1.1–2.5%). The prevalence of CDH did not differ significantly between men and women (1.4% vs. 2.3%, respectively; p = 0.28) (Table 1).

The prevalence of CDH was higher among subjects with up to a middle-school level of education than among those with at least a high-school level of education. Of the 27 subjects with CDH, 6 (22.2%) reported that the headache had little or no impact, 8 (29.6%) reported some impact, 5 (14.8%) reported a substantial impact, and 8 (33.3%) reported a severe impact. The clinical characteristics of the subjects with CDH are summarized in Table 2. Seven (25.9%) of the subjects with CDH met the criteria for MO, of which three overused symptomatic prescription drugs and two overused acetaminophen; the remaining subject did not know the name of the overused drug. Eight (66.7%) subjects with CDH were diagnosed with CM.

Medical consultations and treatment for CDH

Of the subjects with CDH, 11 (40.7%) had previously consulted a doctor for their headaches. The reported HIT-6 score was higher in subjects with CDH who had participated in a medical consultation than in those who had not (61.7 ± 9.3 vs. 53.7 ± 8.7, p = 0.05). CDH subjects with MO were more likely to have consulted a doctor than were CDH subjects without MO (28.3 ± 3.7 vs. 27.9 ± 5.2, p = 0.39) and the score on a visual analogue scale for headache intensity (6.2 ± 1.1 vs. 5.1 ± 0.9, p = 0.06) did not differ significantly between individuals who had or had not participated in a medical consultation.

Of the subjects with CDH, 16 (92.9%) had visited a doctor, and of these, 11 (68.8%) had visited a doctor for their headaches. The frequency of CDH (28.3 ± 3.7 vs. 27.9 ± 5.2, p = 0.39) and the score on a visual analogue scale for headache intensity (6.2 ± 1.1 vs. 5.1 ± 0.9, p = 0.06) did not differ significantly between groups. Eighteen (66.7%) subjects with CDH were diagnosed with CM.

Discussion

The 1-year prevalence of CDH was 1.8% and MO was associated with CDH in one-quarter of the cases in this study. MO was the predominant form of CDH, with two-thirds of subjects with CDH being diagnosed with CM. Approximately half of the subjects with CDH reported having consulted a doctor for their headaches and only one-third of subjects with CDH used prescription drugs to treat their headache symptoms.

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The reported prevalence of CDH in Asian countries has ranged between 1.0% and 3.9%.18-23 These rates are similar or slightly lower than those in Western countries, which range between 2.0% and 7.6%.5-7,24-27 The prevalence of CDH in the present study was similar to that found in other Asian countries (Table 3). The discrepancy in CDH prevalence between Asian and Western countries may be explained by factors such as differences in the race, health-care system, socioeconomic status, body mass index, diet, and cultural background.28-30 Racial differences in pain perception and response have been identified in some clinical trials.31 Factors related to the health-care system factors include access to doctors and medications.32 The prevalence rates of CDH were reported to be higher among individuals with a lower socioeconomic status.33 Chronic daily headache was more prevalent in women than in men in these previous studies, with reported female-to-male ratios ranging from 1.6 to 2.6 (Table 3).4,5,20,23,27,34 The gender ratio in the present study was similar to those found in previous studies. The absence of a significant difference in the prevalence of CDH in men versus women in the present study may have been due to the small number of CDH cases in the present study.

In the present study, MO was associated with CDH in 25.9% of subjects, while previous hospital-based studies found that more than half of subjects with CDH had MO.1,35 Population-based studies have revealed a weaker association between MO and CDH, with a prevalence ranging from 25.1% to 34.0%.2,4,6,20,25,34 The discrepancy in the prevalence of MO between population- and hospital-based studies may be due to differences in symptom severity. CDH subjects with MO had more severe symptoms compared to CDH subjects without MO,36 which may have resulted in increased visits to hospitals among the former, and a consequently higher prevalence of MO in hospital-based studies.

While the diagnosis of CM remains a matter of controversy, it has been shown to be a prevalent form of CDH in previous population- and hospital-based studies.20,27,34,35 Two-thirds of the subjects with CDH in the present study were diagnosed with CM. This high incidence suggests that CDH treatment strategies would benefit from recent advances in CM treatments.38-41 An effective treatment strategy for CDH other than that used for CM has not yet been identified.42 Previous stud-

### Table 2. Clinical characteristics of cases identified as having CDH, CDH with CM, and CDH without CM

|                      | All CDH, n (%) | CDH with CM, n (%) | CDH without CM, n (%) | p*          |
|----------------------|----------------|--------------------|-----------------------|-------------|
| **Headache characteristics** |                |                    |                       |             |
| Headache days per month (mean±SD) | 28.5±0.8     | 28.4±1.7           | 28.6±3.9             | 0.95        |
| Unilateral pain      | 8 (29.6)      | 14 (77.8)          | 5 (55.6)              | 0.23        |
| Pulsating quality    | 11 (40.7)     | 12 (66.7)          | 4 (44.4)              | 0.27        |
| Aggravation of headache by movement | 12 (44.4) | 7 (38.9)          | 8 (88.9)              | 0.01        |
| **Headache severity** |                |                    |                       |             |
| Mild                 | 11 (40.7)     | 6 (33.3)           | 5 (55.6)              | 0.26        |
| Moderate             | 12 (44.4)     | 8 (44.4)           | 4 (44.4)              |             |
| Severe               | 4 (14.8)      | 4 (22.2)           | 0 (0.0)               |             |
| VAS for pain intensity (mean±SD) | 5.5±1.8  | 5.3±1.8           | 6.0±1.9               | 0.38        |
| **Associated symptoms** |                |                    |                       |             |
| Nausea               | 18 (66.7)     | 18 (100.0)         | 0 (0.0)               |             |
| Vomiting             | 11 (40.7)     | 11 (61.1)          | 0 (0.0)               |             |
| Photophobia          | 8 (29.7)      | 8 (44.4)           | 0 (0.0)               |             |
| Phonophobia          | 17 (63.0)     | 13 (72.2)          | 4 (44.4)              | 0.16        |
| Osmophobia           | 16 (59.3)     | 12 (66.7)          | 4 (44.4)              | 0.27        |
| Duration of headache in hours (mean±SD) | 2.9±4.4     | 3.7±5.2           | 1.3±1.4               | 0.23        |
| **HIT-6 score**      |                |                    |                       |             |
| Little-to-no impact  | 6 (22.2)      | 4 (22.2)           | 2 (22.2)              |             |
| Some impact          | 8 (29.6)      | 3 (16.7)           | 5 (55.6)              |             |
| Substantial impact   | 4 (14.8)      | 4 (22.2)           | 0 (0.0)               |             |
| Severe impact        | 9 (33.3)      | 7 (38.9)           | 2 (22.2)              |             |
| Total HIT-6 score (mean±SD) | 55.7±9.5   | 56.4±9.6          | 52.6±8.4              | 0.16        |
| Total                | 27 (100.0)    | 18 (66.7)          | 9 (33.3)              |             |

*p*Comparison between CDH with and without CM. CDH: chronic daily headache, CM: chronic migraine, HIT-6: six-question headache impact test, VAS: visual analogue scale.
| Country, year   | Study/first author | Methods                                      | Sample size | Age (years) | CDH prevalence | Men:women | CM     | MOH | CTTH |
|----------------|--------------------|----------------------------------------------|-------------|-------------|----------------|-----------|--------|-----|------|
| Denmark, 1991  | Rasmussen          | Clinical interview and examination           | 740         | 25–64       | 1-year         | ND        | ND     | ND  | ND   |
| Germany, 1994  | Göbel              | Questionnaire                                | 4061        | >15         | Lifetime       | ND        | ND     | ND  | ND   |
| Chile, 1998    | Lavadas            | Questionnaire                                | 1385        | >14         | 1-year         | ND        | ND     | ND  | ND   |
| USA, 1998      | Scher              | Telephone interview                          | 13343       | 18–65       | 1-year, 4.1%   | 2.8:5.0%  | ND     | ND  | ND   |
| Spain, 1999    | Castillo           | Clinical interview and examination           | 1883        | >44         | Unknown, 4.7%  | Women, 90% | ND    | ND  | ND   |
| Norway, 2000   | Head HUNT/Hagen    | Questionnaire                                | 51383       | >20         | 1-year, 2.0%   | 1.7:2.8%  | ND     | ND  | ND   |
| France, 2003   | GRM2000/Lantéri-Minet | Interview                               | 10585       | >15         | Point, 3.0%    | ND        | 72.3%  | ND  | ND   |
| The Netherlands, 2006 | Wendels          | Questionnaire                                | 16232       | 25–55       | 3-month, 3.7%  | ND        | ND     | ND  | ND   |
| Denmark, 2005  | Russell            | Questionnaire                                | 3471        | 40          | 1-year         | ND        | ND     | ND  | ND   |
| Norway, 2008   | Akerhus study/Grande | Clinical interview and examination        | 20598       | 30–44       | 1-year, 2.9%   | ND        | ND     | ND  | ND   |
| Brazil, 2008   | Queiroz            | Telephone interview                          | 3848        | 18–79       | 1-year, 6.9%   | 4.0:9.5%  | 72.0%  | ND  | 26.0% |
| Georgia, 2009  | Katsarava          | Interview                                    | 1145        | >15         | 1-year, 7.6%   | 5.1:9.3%  | 1.4%   | 0.9%|
| Malaysia, 1996 | Alden              | Door-to-door survey                          | 595         | 5–87        | 1-year, 2.4%   | ND        | 0.6%   | ND  | ND   |
| Taiwan, 2000   | KINDS, Wang        | Interview                                    | 3377        | ≥65         | 1-year, 3.9%   | 1.8:5.6%  | 1.0%   | 1.0%| 25.0%|
| Taiwan, 2001   | Lu                 | Telephone interview                          | 2096        | 15–92       | 1-year, 3.2%   | 1.9:4.3%  | 1.7%   | 1.1%|
| Singapore, 2001| Ho                 | Interview                                    | 2096        | 14–74       | 1-year, 3.3%   | ND        | ND     | ND  | ND   |
| India, 2010    | Lifting the Burden, Rao | Interview                             | 2329        | 18–65       | 1-year, 2.9%   | ND        | ND     | ND  | 41%  |
| China, 2012    | Lifting the Burden, Yu | Interview                             | 5041        | 18–65       | 1-year, 1.0%   | 0.5:1.4%  | ND     | 0.6%| ND   |
| Korea, 2009    | Korean Headache Survey (present study), Chu | Interview                             | 1507        | 19–65       | 1-year, 1.8%   | 1.4:2.3%  | 66.7%  | 25.9%| ND   |

CDH: chronic daily headache, CM: chronic migraine, CTTH: chronic tension-type headache, MOH: medication-overuse headache, ND: no data.
ies found that a significant proportion of subjects with CDH experience a decreased quality of life because of factors such as disability or an impact to perform the activities of normal daily life. In the present study, approximately half of subjects (48.1%) with CDH reported that their headaches had a substantial-to-severe impact on their quality of life, which was a higher proportion than in previous studies examining migraine (31.5%) and tension-type headache (7.1%). Although a direct comparison is not possible because of the use of different assessment tools, the HIT-6 results for CDH in the present study were comparable to those of previous studies. Less than half of the subjects with CDH in the present study participated in a medical consultation. Furthermore, a significant proportion of subjects with CDH either did not treat their headaches or used only OTC medication. These proportions differ from those in previous studies, which could be explained by several possible factors. First, migraine symptoms, which are commonly associated with CDH, have been reported to be milder in Asian countries than in Western countries. A lower severity of symptoms may decrease the rate of subjects seeking a medical consultation and treatment. Second, the cultural background may influence how reluctant individuals are to treat their headache with medications. For example, many individuals with headache in Korea concerned about developing substance dependency when they use medication regularly and may therefore fail to seek proper treatment for their headaches despite their suffering. Considering that approximately half of the subjects with CDH reported substantial-to-severe headache impact scores, the proper diagnosis and treatment of CDH might reduce the adverse impact of headaches on quality of life in these subjects. The similarity of the sociodemographic distributions of our samples and the total Korean population ensured that the data were representative of the general population. In addition, our study collected data through face-to-face semistructured interviews. Face-to-face interviews are favored over telephone interviews or mail surveys since they yield higher quality and more accurate data. The current study was subject to several limitations. First, we defined subjects with CDH as having CM if they were also diagnosed with either migraine or PM. The new appendix criteria for CM were not strictly applied because the exact number of days of migraine or PM was difficult to determine using the questionnaire method. Furthermore, the diagnostic criteria for CM remain a matter of controversy and continue to require further revision. Second, we did not thoroughly investigate the secondary causes of CDH other than MO because this is difficult to document with the questionnaire method used in this population study. Third, although this was a population-based study with a low sampling error, its statistical power was limited for examining subgroups. Thus, some of the comparisons might not have reached statistical significance due to the smallness of the sample rather than the actual absence of group differences.

This is the first nationwide study to examine the clinical epidemiology of CDH in a general Korean population. The results of the present study indicate that promoting physician consultation for CDH and increasing public awareness may reduce the burden of CDH in Korea. Further studies examining the major factors contributing to the debilitating effects of CDH and their impact on quality of life would provide a significant health benefit for the Korean population.

Conflicts of Interest
The authors have no financial conflicts of interest.

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REFERENCES
1. Mathew NT. Chronic refractory headache. Neurology 1993;43(Suppl 3):S26-S33.
2. Pascual J, Colás R, Castillo J. Epidemiology of chronic daily headache. Curr Pain Headache Rep 2001;5:529-536.
3. Buse DC, Manack AN, Fanning KM, Serrano D, Reed ML, Turkel CC, et al. Chronic migraine prevalence, disability, and sociodemographic factors: results from the American Migraine Prevalence and Prevention Study. Headache 2012;52:1456-1470.
4. Lantéri-Minet M, Auray JP, El Hasnaoui A, Dartigues JF, Duru G, Henry P, et al. Prevalence and description of chronic daily headache in the general population in France. Pain 2003;102:143-149.
5. Hagen K, Zwart JA, Vatten L, Stovner LJ, Bovim G. Prevalence of migraine and non-migrainous headache--head-HUNT, a large population-based study. Cephalalgia 2000;20:900-906.
6. Queiroz LP, Peres MF, Kowacs F, Piovesan EJ, Cicciarelli MC, Souza JA, et al. Chronic daily headache in Brazil: a nationwide population-based study. Cephalalgia 2008;28:1264-1269.
7. Rasmussen BK, Jensen R, Schroll M, Olesen J. Epidemiology of headache in a general population--a prevalence study. J Clin Epidemiol 1991;44:1147-1157.
8. Dodick DW, Turkel CC, DeGryse RF, Aurora SK, Silberstein SD, Lipton RB, et al. OnabotulinumtoxinA for treatment of chronic migraine: pooled results from the double-blind, randomized, placebo-controlled phases of the PREEMPT clinical program. Headache 2010; 50:921-936.
9. Headache Classification Committee, Olesen J, Biousser MG, Diener HC, Dodick D, First M, et al. New appendix criteria open for a broader concept of chronic migraine. Cephalalgia 2006;26:742-746.
10. Headache Classification Committee of the International Headache Society (IHS). The International Classification of Headache Disorders, 3rd edition (beta version). Cephalalgia 2013;33:629-808.
11. Kim BK, Chu MK, Lee TG, Kim JM, Chung CS, Lee KS. Prevalence and impact of migraine and tension-type headache in Korea. J Clin Neurol 2012;8:204-211.
12. Council for International Organizations of Medical Sciences [Internet]. International Ethical Guidelines for Biomedical Research Involving Human Subjects. Geneva: Council for International Organis-
zations of Medical Sciences: 2002 [updated 2002; cited 2013 Sep 11]. Available from: http://www.cmns.ch/publications/guidelines/guide-
lines_nov_2002_blurb.htm.

13. World Medical Association [Internet]. WMA declaration of Helsinki [Internet]. Available from: http://www.wma.net/en/30publications/10policies/b3/index.html.pdf?print-media-
type&footer-right=[page]/IoPage.

14. Statistics Korea [Internet]. Korean Statistical Information Service. Daejon: Statistics Korea; 2009 [updated 2009; cited 2013 Sep 18]. Available from: http://kosis.kr.

15. Yoon YO, Kim KY, Lee MH. Redesigning KNSO’s household survey sample. Surv Res 2004;5:103-130.

16. Kosiński M, Baylis MS, Bjomne JB, Ware JE Jr, Garber WH, Baten-
horst A, et al. A six-item short-form survey for measuring headache impact: the HIT-6. *Qual Life Res* 2003;12:963-974.

17. Chu MK, Im HJ, Ju YS, Yu KH, Ma HI, Kim YJ, et al. Validity and reliability assessment of Korean Headache Impact Test-6 (HIT-6). *J Korean Neurol Assoc* 2009;27:1-6.

18. Alders EE, Hentzen A, Tan CT. A community-based prevalence study on headache in Malaysia. *Headache* 1996;36:379-384.

19. Ho KH, Ong BK. Headache characteristics and race in Singapore: results of a randomized national survey. *Headache* 2001;41:279-284.

20. Lu SR, Fuh JL, Chen WT, Jiang KD, Wang SJ. Chronic daily headache in Taiwan: prevalence, follow-up and outcome predictors. *Cephalalgia* 2001;21:980-986.

21. Rao GN, Kulkarni GB, Gouraraj G, Rajesh K, Subbakrishna DK, Steiner TJ, 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.

22. Wang SJ, Fuh JL, Lu SR, Liu CY, Hsu LC, Wang PN, et al. Chronic daily headache in Chinese elderly: prevalence, risk factors, and biannual follow-up. *Neurology* 2000;54:314-319.

23. Yu S, Liu R, Zhao G, Yang X, Qiao X, Feng J, et al. The prevalence and burden of primary headaches in China: a population-based door-to-door survey. *Headache* 2012;52:582-591.

24. Bigal ME, Pepper SJ, Sheftell FD, Rapoport AM, Lipton RB. Field testing alternative criteria for chronic migraine. *Cephalalgia* 2006;26:477-482.

25. Grande RB, Asesh K, Gulbrandsen P, Lundqvist C, Russell MB. Prevalence of primary chronic headache in a population-based sample of 30- to 44-year-old persons. The Akershus study of chronic headache. *Neuropediatrics* 2008;30:76-83.

26. Katsarava Z, Dzagnidze A, Kukava M, Mirvelashvili E, Djibuti M, Janelidze M, et al. Primary headache disorders in the Republic of Georgia: prevalence and risk factors. *Neurology* 2009;73:1796-1803.

27. Scher AI, Stewart WF, Liberman J, Lipton RB. Prevalence of frequent headache in a population sample. *Headache* 1998;38:497-506.

28. Bigal ME, Lipton RB. Obesity is a risk factor for transformed migraine but not chronic tension-type headache. *Neurology* 2006;67:252-257.

29. Stark RJ, Ravishankar K, Siow HC, Lee KS, Pepperle R, Wang SJ. Chronic migraine and chronic daily headache in the Asia-Pacific region: a systematic review. *Cephalalgia* 2013;33:266-283.

30. Stewart WF, Lipton RB, Liberman J. Variation in migraine prevalence by race. *Neurology* 1996;47:52-59.

31. Lasch KE. Culture and pain. *Pain* Clin Updates 2002;10:1-9.

32. Lipton RB, Scher AI, Steiner TJ, Bigal ME, Kolodner K, Liberman JN, et al. Patterns of health care utilization for migraine in England and in the United States. *Neurology* 2003;60:441-448.

33. Scher AI, Stewart WF, Ricci JA, Lipton RB. Factors associated with the onset and remission of chronic daily headache in a population-based study. *Pain* 2003;106:81-89.

34. Castillo J, Muñoz P, Guituera V, Pascual J. Kaplan Award 1998. Epidemiology of chronic daily headache in the general population. *Headache* 1999;39:190-196.

35. Bigal ME, Serrano D, Reed M, Lipton RB. Chronic migraine in the population: burden, diagnosis, and satisfaction with treatment. *Neurology* 2008;71:559-566.

36. Sub GI, Park PW, Shin HE. Differences in clinical features and disabil-
ity according to the frequency of medication use in patients with chronic migraine. *J Clin Neurol* 2012;8:198-203.

37. Bigal ME, Shelhel FD, Rapoport AM, Lipton RB, Tepper SJ. Chronic daily headache in a tertiary care population: correlation between the International Headache Society diagnostic criteria and proposed revisions of criteria for chronic daily headache. *Cephalalgia* 2002;22:432-438.

38. D’Amico D. Pharmacological prophylaxis of chronic migraine: a re-
view of double-blind placebo-controlled trials. *Neuror Sci* 2010;31 Suppl 1:S23-S28.

39. Diener HC, Dodick DW, Aurora SK, Turkel CC, DeGrave RE, Lipton RB, et al. OnabotulinumtoxinA for treatment of chronic migraine: results from the double-blind, randomized, placebo-controlled phase of the PREEMPT 2 trial. *Cephalalgia* 2010;30:804-814.

40. Silberstein SD, Lipton RB, Dodick DW, Freitag FG, Ramadan N, Mathew N, et al. Efficacy and safety of topiramate for the treatment of chronic migraine: a randomized, double-blind, placebo-controlled trial. *Headache* 2007;47:170-180.

41. Yurekli VA, Akhan G, Kurluhan S, Uzar E, Koyuncuoglu HR, Gultekin F. The effect of sodium valproate on chronic daily headache and its subgroups. *J Headache Pain* 2008;9:37-41.

42. Diener HC, Dodick DW, Goadsby PJ, Lipton RB, Olesen J, Silberstein SD. Chronic migraine—classification, characteristics and treatment. *Nat Rev Neurol* 2012;8:162-171.

43. Bigal ME, Rapoport AM, Lipton RB, Tepper SJ, Sheftell FD. Assessment of migraine disability using the migraine disability assessment (MIDAS) questionnaire: a comparison of chronic migraine with episodic migraine. *Headache* 2003;43:336-342.

44. D’Amico D, Grazzi L, Usai S, Raggi A, Leonardi M, Bussone G. Disability in chronic daily headache: state of the art and future directions. *Neuror Sci* 2011;32 Suppl 1:S71-S76.

45. Wang SJ. Epidemiology of migraine and other types of headache in Asia. *Curr Neurol Neurosci Rep* 2003;3:104-108.

46. Roh JK, Kim JS, Ahn YO. Epidemiologic and clinical characteristics of migraine and tension-type headache in Korea. *Headache* 1998;38:356-365.

47. Rasmussen BK, Jensen R, Olesen J. Questionnaire versus clinical in-
terview in the diagnosis of headache. *Headache* 1991;31:290-295.

48. Headache Classification Subcommittee of the International Headache Society. The International Classification of Headache Disorders- 2nd edition. *Cephalalgia* 2004;24 Suppl 1:9-160.

49. Göbel H, Petersen-Braun M, Soysa D. The epidemiology of headache in Germany: a nationwide survey of a representative sample on the basis of the headache classification of the International Headache Society. *Cephalalgia* 1994;14:97-106.

50. Lavados PM, Tenhann E. Epidemiology of tension-type headache in Santiago, Chile: a prevalence study. *Cephalalgia* 1998;18:552-558.

51. Wiendels NJ, Knustingh Neven A, Rosendaal FR, Spinnoven P, Zit-
man FG, et al. Chronic frequent headache in the general population: prevalence and associated factors. *Cephalalgia* 2006;26:1434-1442.

52. Russell MB. Tension-type headache in 40-year-olds: a Danish popula-
tion-based sample of 4000. *J Headache Pain* 2005;6:441-447.