Incidence and Risk Factors of Chronic Daily Headache in Young Adolescents: A School Cohort Study

**WHAT’S KNOWN ON THIS SUBJECT:** Several studies have investigated the prevalence of chronic daily headache (CDH) and analyzed the risk factors for its persistence. However, the etiologic factors that lead to new-onset CDH remain unsettled in adolescents.

**WHAT THIS STUDY ADDS:** This study was the first incidence study of CDH conducted in young adolescents. We reported the incidence rates and found that some risk factors for incident chronic migraine and chronic tension-type headache were different.

**OBJECTIVES:** This study investigated the incidence and risk factors of chronic daily headache (CDH) and its major subtypes in young adolescents.

**METHODS:** A field cohort of 3342 adolescents aged 13 to 14 was established in 3 middle schools in Taitung, Taiwan, from 2005 to 2007. Participants without CDH at baseline were annually followed up for 1 to 2 years using the same questionnaires, including the Adolescent Depression Inventory and Pediatric Migraine Disability Assessment. The neurologists made the headache diagnoses based on clinical interviews and headache diaries. The person-time incidence rates and risk factors of incident CDH and its subtypes (ie, chronic migraine [CM] and chronic tension-type headache [CTTH]) were calculated by using Cox proportional hazards models.

**RESULTS:** The cohort completed 5586 person-years (PYs) of follow-up. Sixty-three subjects (21 boys/42 girls) developed incident CDH with an incidence rate of 1.13 per 100 PYs, including 37 with CM (0.66 per 100 PYs) and 22 with CTTH (0.39 per 100 PYs). Thirty-three subjects (52%) had a baseline diagnosis of migraine. The independent risk factors for incident CDH and its subtypes (ie, chronic migraine [CM] and chronic tension-type headache [CTTH]) were calculated by using Cox proportional hazards models.

**CONCLUSIONS:** Incident CDH was common in young adolescents. Some risk factors for incident CM and CTTH were different. *Pediatrics* 2013;132:e9–e16

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**KEY WORDS**
adolescence, incidence, migraine headache, tension-type headache, risk factors

**ABBREVIATIONS**
ADI—Adolescent Depression Inventory
CDH—chronic daily headache
CI—confidence interval
CM—chronic migraine
CTTH—chronic tension-type headache
HR—hazard ratios
ICHD-2—International Classification of Headache Disorders, 2nd edition
ICHD-2R—revision of ICHD-2
IQR—interquartile ranges
MINI-Kid—Mini-International Neuropsychiatric Interview for Children and Adolescents
PedMIDAS—Pediatric Migraine Disability Assessment
PYs—person-years

Dr Lu collected, analyzed, and interpreted the data and was responsible for drafting and revising the manuscript; Dr Fuh developed the concept, designed the study, collected and analyzed the data, revised the manuscript, and approved the final manuscript as submitted; Dr S.J. Wang developed the concept, designed the study, collected and analyzed the data, drafted the initial manuscript, revised the manuscript, and approved the final manuscript as submitted; Dr Juang developed the concept, designed the study, and collected the data; and Drs Chen, Liao, and Y.F. Wang collected and analyzed the data.

(Continued on last page)
Chronic daily headache (CDH), defined as ≥15 headache days per month for >3 months, is a worldwide health issue.\(^1\)\(^2\) The International Classification of Headache Disorders, Second Edition (ICHD-2) and its revision (ICHD-2R) define the following CDH subtypes: chronic migraine (CM), chronic tension-type headache (CTTH), new daily-persistent headache, and hemicrania continua.\(^3\)\(^4\) These subtypes are also applied to adolescents.

By examining the factors that contribute to incident (new-onset) CDH, some determinants may emerge as potential targets for prevention and treatment. A study in the United States showed that the 1-year incidence of CDH was 3% in adults, and risk factors included obesity and baseline headache frequency.\(^5\) In children and adolescents, the incidence and risk factors of CDH are largely unknown.

This prospective survey aimed to investigate the person-time incidence rate of CDH and its subtypes (ie, CM and CTTH) in young adolescents who had been followed up for 1 or 2 years and to identify the relevant risk factors for incident CDH, CM, and CTTH.

**METHODS**

**Setting**

This investigation was part of the Taitung County Adolescent Headache Survey (see Supplemental Information).\(^5\) We selected 3 public middle schools in Taitung County: Tung-Hai, Shin-Sheng, and Chih-Pen. The seventh and eighth graders at these schools were our sample population; they accounted for 46% of adolescents aged 13 to 14 years in Taitung County attending middle schools and could be regarded as a community-based sample.

We estimated the required sample size was 3282 participants based on the population size of 9336, an assumed incidence of 1.2% with a margin of error of 0.3%. To build a large baseline cohort for the study of CDH incidence, we recruited all the seventh graders at Shin-Sheng and all the seventh and eighth graders at Tung-Hai and Chih-Pen middle schools in 2005 and continued recruiting all the seventh graders at Tung-Hai and Chih-Pen middle schools in 2006 and 2007 (Fig 1A). Those with a diagnosis of CDH at baseline were excluded from the cohort. We then annually followed up on this cohort from 2006 to 2009 while they were still at school to determine if they developed new-onset CDH (ie, incident cases). Because students spend 3 years in middle school (grades 7–9), we could perform 1 or 2 annual follow-ups during their middle school years.

The Institutional Review Board of the Kaohsiung Medical University reviewed the medical ethics of this study and the Education Department of the Taitung County Government approved the study before it commenced.

**Questionnaire**

The participants answered the survey questionnaires in class by themselves with the help of teachers and school nurses. The questionnaires contained 4 parts (see Supplemental Information):

1. Sociodemographics: the collected data included age, gender, body weight and height, living arrangements, highest parental educational levels, parental occupations, self-reported household economic status and acute family distress in the past year, parent-child relations, and consumption of painkillers.

2. A validated headache questionnaire for adolescents based on the ICHD-2 and ICHD-2R was used for headache diagnoses.\(^6\)

3. A validated depression questionnaire, the Adolescent Depression Inventory (ADI), was used to survey depressive symptoms in the previous month. A score ≥19 was defined as depression.\(^7\)

4. A validated Taiwanese version of the Pediatric Migraine Disability Assessment (PedMIDAS) was used to assess headache disability during the previous 3 months from grade I (no disability) to IV (severe disability).\(^8\)–\(^10\)

**Neurologic Evaluation**

Within 3 weeks of the questionnaire screening, subjects who might have CDH were selected (see Supplemental Information). After obtaining the written consent forms from parents, our neurologists conducted neurologic examinations and semistructured interviews on these potential CDH cases at their schools. The subjects were asked if they had had CDH in the past; only those who did not have CDH at baseline but developed it later were counted as incident CDH cases. The approximate start and end dates of incident CDH were estimated by using 1-month steps. They were asked, trying their best, to describe at least 2 headache phenotypes they had experienced. The neurologists diagnosed each headache phenotype, determined the frequency of attacks, and recorded the amount of medication usage. Obvious secondary causes of headaches were excluded. To facilitate the diagnoses, the subjects who were diagnosed as having CDH were asked to keep a headache diary for 1 month. The headache diary and the neurologists’ diagnosis were discussed in a consensus meeting, and the final diagnosis of CDH and its subtypes were made.

In this study, CDH was defined as headache occurring at a frequency ≥15 days per month, with an average of ≥2 hours per day, for ≥3 months. We shortened the headache duration criterion from ≥4 hours to ≥2 hours for adolescents.\(^11\)–\(^12\) CDH subtypes were classified as CTTH based on the ICHD-2 criteria\(^3\) and as CM based on the ICHD-2R criteria,\(^4\) with the exception that the number of days with
probable migraine attacks was also counted as migraine days. Subjects who met the criteria for CTH through physician interview but CM based on the headache diary, or vice versa, were classified as CM. CDH subjects who did not fulfill the criteria for either CM or CTH were classified as “unclassified CDH.” Medication overuse was considered an associated diagnosis of CDH if the ICHD-2R criteria were met. A computer algorithm was used to make migraine diagnoses according to the ICHD-2 criteria, including migraine without aura, migraine with aura, and probable migraine.

Psychiatric Interview
Without knowledge of the headache diagnoses, a board-certified psychiatrist (K.D. Juang) interviewed the adolescents with CDH on the same day of the neurologic evaluation using the structured Mini-International Neuropsychiatric Interview for Children and Adolescents (MINI-Kid, version 1.01). The assessed psychiatric disorders included depression and anxiety. The score in the MINI Suicidality Module was used to measure the suicidal risk (high risk if the score was ≥10, see Supplemental Information).

FIGURE 1
The Diagnostic Process

The population of the 3 middle schools was 3577 adolescents (1834 boys and 1743 girls, mean age 13.2 ± 0.5 years) who were aged 13 (seventh graders, n = 2915) to 14 (eighth graders, n = 662) during the recruitment period. Of these, 5391 (94.8%) adolescents (1720 boys and 1671 girls, mean age 13.2 ± 0.5 years) finished the baseline survey. Forty-nine subjects (1.45%) were diagnosed as having CDH at the baseline survey (boys: 1.10% and girls: 1.80%, P = .095). After excluding these subjects, the incidence cohort consisted of 3342 subjects (1701 boys and 1641 girls, mean age 13.2 ± 0.5 years) who were seventh graders (n = 2734) and eighth graders (n = 608).

To ensure the consistency of diagnoses, the diagnostic process was the same at both the baseline survey and the annual follow-up, including the questionnaire survey, neurologic evaluation, psychiatric interview for potential CDH subjects, and headache diary recording for incident CDH subjects, except those incident CDH subjects diagnosed in the previous year would also be interviewed. The same strategies were applied for prevalent and incident CDH cases. Those students who missed the annual follow-up due to sick leave would be contacted by telephone.

Definition of Variables

The self-reported body heights and weights were crosschecked with the records in the school nurse’s office to minimize the report bias. BMI was calculated as body weight divided by body height squared (kg/m²). Obesity was defined according to the age- and gender-specific BMI criteria of the Taiwanese Department of Health. Lower household economic status was defined if it was “below average” or “poor”; lower parental educational level was defined as middle school diploma or less for both parents; lower parental occupational level was defined as both parents being skilled, semiskilled, or unskilled workers; acute family financial distress was defined as the presence of a tight household budget or parental unemployment that occurred in the past year.

Statistical Analysis

Data were analyzed by using SPSS version 20, after sensitive personal information had been masked. Continuous variables were expressed as means with standard deviations or medians with interquartile ranges (IQR). Student’s t, χ², Fisher’s exact, or Mann-Whitney tests were used for comparisons when appropriate. For each participant, the person-years (PYs) of follow-up were counted from the baseline interview to the last annual follow-up. The incidence rates of CDH and its subtypes were calculated and reported as the number of new cases per 100 PYs with 95% confidence interval (CI).

The potential risk factors for incident CDH and its subtypes (see Supplemental Information) were presented as relative risks with 95% CI. Variables that were associated with incident CDH with a significance level of P < .25 in univariate analysis and missing answers for <10% of the participants were selected for a stepwise multivariate Cox proportional hazards analysis. Using 1-month steps, time at entry was the date of recruitment, time of exit was the last annual follow-up for non-CDH subjects or the self-reported date of CDH onset for incident cases. The independent predictors for incident CDH and its subtypes were presented as hazard ratios (HR) with 95% CIs. Two-tailed P values <.05 were considered significant.

RESULTS

Participants

Of the incidence cohort, 567 (293 boys and 274 girls) eighth graders and 2584 (1292 boys and 1292 girls) seventh graders finished the first annual follow-up, and 2435 (1214 boys and 1221 girls) seventh graders finished the second annual follow-up (Fig 1B). As a whole, there were 5586 PYs of follow-up. The participation rate for ≥ 1 annual follow-up was 94.3%. Forty-one of the eighth graders and 150 of the seventh graders were lost to the first annual follow-up, and 119 of the seventh graders were lost to the second annual follow-up. The reasons for the loss to follow-up included migration and dropping out. The comparisons between the participants and those lost to the first or second annual follow-up are provided in Supplemental Information.

Incidence Rate of CDH

During the follow-up period, 241 potential cases of new-onset CDH were selected and interviewed by the neurologists. Of these cases, 63 adolescents (21 boys and 42 girls, mean age at baseline 13.0 ± 0.4 years) were diagnosed with incident CDH. Most of them (n = 57, 90.5%) completed a headache diary for 1 month. Their median headache frequency during the past 3 months was 16 days per month (IQR 15–19), and median PedMIDAS score was 9 (IQR 2–15). Five (7.9%) incident CDH subjects overused acute medications. The person-time incidence rate of incident CDH was 1.13 per 100 PYs. Table 1 shows the age-, cohort-, school-, gender-, and subtype-specific incidence rates of CDH. Girls had a higher incidence rate of CDH than boys (1.51 vs 0.75 per 100 PYs, P = .007).

CDH Subtype Classification

Of the 63 subjects with incident CDH, 37 (58.7%) had CM with an incidence rate of 0.66 per 100 PYs, and 22 (34.9%) had CTH with an incidence rate of 0.39 per 100 PYs (Table 1). Of the 22 incident CTH subjects, 7 (31.8%) also had episodic migraine or probable migraine. Girls had a higher incidence rate of CTH than boys (0.65 vs 0.14 per 100 PYs, P = .003). Four subjects (6.3%) had “unclassified
CDH, which could not be classified as either CM or CTH because they had episodic tension-type headache for <14 days and migraine or probable migraine for <8 days per month.

### The Diagnosis of Migraine

Of the 3342 subjects in the incident cohort, 820 (24.5%) had migraine or probable migraine at baseline, and 754 of them had completed the annual follow-up. Of these, 33 (4.4%) had developed incident CDH at the follow-up, including 20 with CM (2.7%), 10 with CTH (1.3%), and 3 with unclassified CDH (0.4%).

### Psychiatric Comorbidity

The subjects with incident CDH had higher ADI scores at baseline compared with those without (median = 14 [IQR 7–18] vs. 7 [IQR 3–13], $P < .001$). Accordingly, depression (ADI scores ≥19) at baseline was more common in subjects with incident CDH than in those without (23.3% vs 7.9%, $P < .001$). Forty-seven of the 63 subjects (74.6%) with incident CDH underwent a psychiatric interview when incident CDH was diagnosed. Thirty-one subjects (65.9%) had ≥1 psychiatric diagnosis, including major depression ($n = 17$, 36.2%), dysthymia ($n = 4$), social phobia ($n = 7$), specific phobia ($n = 9$), obsessive-compulsive disorder ($n = 7$), panic disorder ($n = 12$), and generalized anxiety disorder ($n = 2$). The median suicide score of incident CDH subjects based on the MINI-Kid was 2 (IQR 0–12), and 12 subjects (25.5%) had a high suicidal risk (≥10 points).

### Risk Factors of Incident CDH

Table 2 shows the results of the univariate analyses of possible risk factors for incident CDH and its 2 major subtypes (CM and CTH). The common risk factors for CDH, CM, and CTH were a higher baseline headache frequency ($≥7$ days/month) and a diagnosis of migraine or probable migraine at baseline. Certain factors such as parental educational and occupational levels, headache severity (PedMIDAS), and the acute medication usage ($≥1$ days/month) did not display any predictive effect.

Fifty-two subjects with incident CDH (vs 2880 controls), 31 with incident CM (vs 2898 controls), and 18 with incident CTH (vs 2914 controls) were available for multivariate analysis. The regression model selected 5 independent risk factors for incident CDH, including female gender, the presence of acute family financial distress, obesity, higher baseline headache frequency, and a diagnosis of migraine or probable migraine at baseline (Table 3). Analysis based on CDH subtypes showed that higher baseline headache frequency, a diagnosis of migraine or probable migraine at baseline, lower household economic status, obesity, and depression were risk factors for CM, whereas female gender and higher baseline headache frequency were risk factors for CTH (Table 3).

### DISCUSSION

The current study reported for the first time the incidence rates of CDH and its major subtypes (CM and CTH) in young adolescents and identified several risk factors that might be of clinical interest.

### The Incidence Rate of CDH

The incidence rate of CDH in young adolescents (aged 13–14, seventh and eighth graders) was 1.13 per 100 PYs, which was stable at the first- and second-year annual follow-up (1.14 vs
1.11 per 100 PYs) and was similar between those recruited as seventh and eighth graders (1.14 vs 1.06 per 100 PYs; Table 1). If we limited the period to 1 year (ie, from seventh to eighth grade or from eighth to ninth grade), the incidence rates between different cohorts were similar (Table 1). Overall, these data were consistent despite of a variation in the composition of the participants and the length of observation.

**Risk Factors for Incident CDH**

The current study identified 5 independent risk factors for incident CDH. Of these, obesity and higher headache frequency were also predictors for incident CDH in adults. This suggests both factors are important for the initiation of CDH in adults and young adolescents, and because both factors are modifiable, they might be targets for primary prevention of incident CDH.

In our previous prevalence study conducted in another school-based sample (seventh to ninth graders), the predictors for persistence of CDH included female gender, acute medication overuse, chronic migraine, major depression, and anxiety disorder. Compared with the current study, some risk factors were common for both incident and prevalent CDH (eg, migraine and female gender), and others were not (ie, medication overuse). It is unclear how these factors interplay and contribute to CDH in young adolescents.

Several independent risk factors for incident CDH, CM, and CTTH found in this study deserve further discussion.

1. High headache frequency: this was the only consistent risk factor for incident CDH, CM, and CTTH. Two longitudinal studies also demonstrated that a higher baseline headache frequency predicted the evolution of CDH and transformed migraine from episodic headache. Higher headache frequency may indicate central sensitization of nociceptive neurons in the trigeminal pathway, thus paving the way to headache chronification and the development of CDH.

2. Migraine or probable migraine at baseline: CM represents a natural evolution from episodic migraine; a baseline diagnosis of migraine was therefore a sine qua non and predictor for CM and CDH in this study. In our cohort, 2.7% of adolescents with migraine or probable migraine at the baseline developed incident CM in 1 to 2 years.

3. Obesity: the relationship between obesity and adult migraine has been highlighted in cross-sectional surveys with mixed results. In young migraineurs, the role of obesity has only been evaluated in clinic-based studies. The prevalence of obesity was not increased in children or adolescents with CM compared with population norms, but obesity or BMI were positively correlated with migraine frequency. Our study provided the epidemiologic evidence in Asians that supports obesity as a risk factor for adolescent CM and CDH.

4. Female gender: our study showed that the incidence rates of CDH and...

**TABLE 2 Univariate Relative Risk (RR) for Incidence of CDH and Its Subtypes in Adolescents**

<table>
<thead>
<tr>
<th>Variable</th>
<th>CDH</th>
<th>Non-CDH</th>
<th>Total CDH</th>
<th>CM</th>
<th>CITH</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(% at risk)</td>
<td>(% at risk)</td>
<td>RR (95% CI)</td>
<td>P</td>
<td>RR (95% CI)</td>
<td>P</td>
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<tr>
<td>Female gender</td>
<td>42/63 (66.7%)</td>
<td>1524/3088 (49.4%)</td>
<td>2.02 (1.20–3.40)</td>
<td>.008</td>
<td>1.33 (0.70–2.54)</td>
<td>.389</td>
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<td></td>
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<td>4.55 (1.54–13.43)</td>
<td>.006</td>
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<tr>
<td>Lower household economic status</td>
<td>32/60 (53.3%)</td>
<td>937/2988 (31.4%)</td>
<td>2.45 (1.49–4.05)</td>
<td>&lt;.001</td>
<td>2.86 (1.47–5.56)</td>
<td>.002</td>
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<td></td>
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<td></td>
<td>1.95 (0.83–4.58)</td>
<td>.125</td>
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<tr>
<td>Lower parental education level</td>
<td>8/44 (18.2%)</td>
<td>401/2379 (16.9%)</td>
<td>1.09 (0.51–2.34)</td>
<td>.816</td>
<td>0.90 (0.31–2.58)</td>
<td>.838</td>
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<td></td>
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<td>1.79 (0.57–5.60)</td>
<td>.316</td>
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<tr>
<td>Lower parental occupation status</td>
<td>15/43 (34.9%)</td>
<td>791/2176 (36.4%)</td>
<td>0.94 (0.50–1.75)</td>
<td>.483</td>
<td>0.74 (0.32–1.68)</td>
<td>.469</td>
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<td>2.05 (0.69–6.07)</td>
<td>.197</td>
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<tr>
<td>Acute family financial distress</td>
<td>23/60 (58.3%)</td>
<td>482/3085 (15.7%)</td>
<td>3.25 (1.93–5.38)</td>
<td>&lt;.001</td>
<td>3.46 (1.77–6.76)</td>
<td>&lt;.001</td>
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<td></td>
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<td></td>
<td>2.42 (1.99–5.91)</td>
<td>.052</td>
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<tr>
<td>Little parenting time</td>
<td>16/58 (27.6%)</td>
<td>465/3086 (15.1%)</td>
<td>2.10 (1.19–3.71)</td>
<td>.010</td>
<td>2.07 (0.97–4.43)</td>
<td>.061</td>
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<td></td>
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<td></td>
<td>1.73 (0.64–4.68)</td>
<td>.285</td>
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<tr>
<td>Baseline headache ≥7 d/mo</td>
<td>11/63 (17.5%)</td>
<td>108/3075 (5.00%)</td>
<td>5.37 (2.88–10.02)</td>
<td>&lt;.001</td>
<td>4.91 (2.09–11.54)</td>
<td>&lt;.001</td>
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<td>7.46 (2.80–19.88)</td>
<td>&lt;.001</td>
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<tr>
<td>Migraine or probable migraine at baseline</td>
<td>35/63 (52.4%)</td>
<td>721/3088 (23.5%)</td>
<td>3.50 (2.15–5.69)</td>
<td>&lt;.001</td>
<td>3.74 (1.97–7.10)</td>
<td>&lt;.001</td>
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<td></td>
<td></td>
<td></td>
<td>2.65 (1.15–6.11)</td>
<td>.022</td>
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<tr>
<td>Depression (ADI ≥13)</td>
<td>14/60 (23.3%)</td>
<td>239/3037 (7.9%)</td>
<td>3.42 (1.91–6.14)</td>
<td>&lt;.001</td>
<td>4.32 (2.11–8.86)</td>
<td>&lt;.001</td>
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<td></td>
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<td></td>
<td>1.98 (0.59–6.72)</td>
<td>.271</td>
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<tr>
<td>Higher PedMDAS grade (grade II–IV)</td>
<td>5/63 (7.9%)</td>
<td>166/3085 (5.4%)</td>
<td>1.50 (0.61–3.69)</td>
<td>.377</td>
<td>2.11 (0.76–5.89)</td>
<td>.154</td>
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<td></td>
<td></td>
<td></td>
<td>0.83 (0.11–6.13)</td>
<td>.854</td>
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<tr>
<td>Acute medication usage ≥1 d/mo</td>
<td>12/62 (19.4%)</td>
<td>390/3082 (12.7%)</td>
<td>1.63 (0.88–3.05)</td>
<td>.120</td>
<td>1.56 (0.57–3.26)</td>
<td>.484</td>
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<td></td>
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<td></td>
<td>2.01 (0.74–5.41)</td>
<td>.168</td>
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<tr>
<td>Obesity</td>
<td>15/63 (23.8%)</td>
<td>502/3071 (16.3%)</td>
<td>1.58 (0.89–2.80)</td>
<td>.116</td>
<td>2.43 (1.23–4.80)</td>
<td>.011</td>
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<td></td>
<td></td>
<td></td>
<td>0.51 (0.12–2.16)</td>
<td>.358</td>
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</table>
CTTH were higher in girls than boys. In a similar vein, a cross-sectional twin study showed the prevalence of CTTH increased in adolescent girls beginning at age 15, whereas it remained unchanged in adolescent boys. Whether sex hormones contribute to this phenomenon is unknown, and further investigation is warranted.

5. Psychological and socioeconomic factors: depression, lower household economic status, and acute family financial distress were predictors for incident CM or CDH in this study. In line with this, our previous longitudinal surveys among young adolescents aged 13 to 15 had demonstrated depression as an important factor for persistence of CDH at follow-up. The role of household economy in adolescent CM had been featured in 1 cross-sectional study, low household income was correlated with CM in those without a family history of migraine, suggesting a role of social causation.

The Diagnostic Issue of CDH, CM, and CTTH in Adolescents

The differences between adult and adolescent CDH are not well understood.

We shortened the duration criterion of CDH to ≥2 hours in this study because young adolescents have shorter headache duration than adults and also counted the days with probable migraine attacks as migraine days. These adjustments had no impact on the incidence of CDH in general but increased the diagnostic rate of CM. Despite this, the distinction between CM and CTTH was not so clear-cut in some of our CDH subjects owing to coexistence of migraine and tension-type headaches. If the ICHD-2R criteria for CM were applied without modification, 5 of our CM subjects would be categorized as CTTH and 3 as unclassified CDH, and the incidence rate of CM, CTTH, and unclassified CDH would be 0.52, 0.48, and 0.13 per 100 PYs, respectively. The ICHD-2R criteria for CM may undergo revision in the near future.

Limitations

Our study has limitations. First, although the participation rate was high throughout the study, the subjects lost to follow-up may bias the results because they shared some characteristics with incident CDH cases (ie, lower household economic status, higher ADI scores, and migraine at baseline). Second, the cohort effect should be considered. Because we recruited subjects of different ages at different time points, the difference in life experience across the generations might have an impact on CDH incidence. Despite that, we found the CDH incidence was consistent among the different cohorts (Table 1), indicating that the cohort effect was not significant. Third, recall bias was inevitable as all demographics and headache features were self-reported by the participants. Nonetheless, we have used various questioning techniques and corroborated the clinical interview with the headache diary to validate the headache diagnoses. Fourth, type II errors could not be avoided while analyzing the risk factors for CDH subtypes because of the relatively small number of cases of CM and CTTH. Fifth, because ethnic discrepancy was found in certain headache disorders, it is uncertain whether the results of this study can be extrapolated to other ethnic groups.

CONCLUSIONS

Our study found that the incidence rate of CDH was 1.13 per 100 PYs in young adolescents and underscores several risk factors associated with incident CDH. Additional research is needed to understand the interactive relationship of these factors in adolescent CDH.

TABLE 3 Stepwise Multivariate Cox Proportional Models of HR and 95% CIs for the Incidence of CDH, CM, and CTTH

<table>
<thead>
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<th>Significant Risk Factors</th>
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