The prevalence, burden and cognizance of migraine in adolescent girls

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Abstract. Migraine represents a common neurological condition, which frequently affects adolescent girls. This cross sectional study aimed to evaluate the prevalence, impact and fund of migraine knowledge among adolescent girls. Students attending randomly selected high schools were recruited into the study by signing a consent form and completing a validated survey designed for this purpose. The survey assessed the participants fund of knowledge about migraine in five domains: migraine epidemiology, symptoms, triggers, auras and treatment options. The participants were evaluated for headache characteristics according to the International Classification of Headache Disorders, 2nd edition criteria, and categorized as having definite migraine or probable migraine. Additionally, the survey evaluated headache disability by implementing the headache impact test-6, and collected information regarding the use of over-the-counter medication. In a cohort of 309 girls, 14–18 years old, 18% fulfilled the criteria for definite migraine and 25% for probable migraine, with mean headache impact test-6 scores of 62.5 and 55.2, respectively ($P < 0.0001$). Furthermore, the students fund of knowledge was substantially limited in regards to migraine auras and moderately limited in regards to symptoms, triggers and treatments. A significant portion of the migraineurs self-medicated using over-the-counter medications. The prevalence of migraine in late adolescent girls is very close to that of adult women. The information regarding the cognizance of migraine ought to be used as a guideline for designing educational tools for this population.

Keywords: Prevalence, migraine, adolescence, girls, burden, cognizance

1. Introduction

Migraine represents both a common condition and a public health issue, which affects women more commonly than men [1]. According to the published population-based studies conducted on adults, migraine affects 17.1% of women and 5.6% of men, with an overall prevalence of 11.7% [2]. The onset of migraine often coincides with puberty [3], the prevalence evolves with age and reaches its peak in the early to mid twenties [4]. A few previous studies [5–8] have evaluated the prevalence of migraine in the younger population using diagnostic criteria recommended by the 2nd edition of the International Classification of Headache Disorders (ICHD-II) [9]. These studies report a prevalence of 10–13% in children between the ages of 9 and 14 years. However, data on the prevalence of migraine among older teenagers remains inadequate. In this study, we sought to investigate the prevalence of migraine among

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older teenage girls (14–18-year-old) in order to better understand its pattern of epidemiological evolution through adulthood.

Traditionally, only individuals who fulfill all of the ICHD-II criteria would be categorized as having migraine. It has been recognized, however, that many headache sufferers who might benefit from migraine treatments do not fit into the strict definition of migraine. Therefore, individuals who meet all but one of the above criteria are categorized as having probable migraine (PM), while patients who meet all of the criteria are categorized as having definite migraine (DM). There are only a few studies on the prevalence of PM in the adult population, and their results vary significantly [10–13]. Very few studies have evaluated the prevalence of PM in younger teenagers [14,15]. Meanwhile, the data on the prevalence of PM in older teenagers remains very limited.

Migraine commonly affects young women, and as such, raising public awareness within this group is paramount to addressing this problem. Understanding the knowledge base of teenage girls regarding migraine is critical for designing educational material for this population of society. To this end, teenage cognizance of migraine, which has not been investigated before, represents another main focus of our study. Furthermore, we endeavored to study the impact of headaches on the daily lives of the young women, as well as their patterns of behavior with respect to the use of over-the-counter (OTC) medications.

2. Materials and methods

We conducted an Institutional Review Board (IRB) approved cross-sectional study at five randomly selected suburban public and private high schools. The rationale for targeting high school students was to access a readily available, random sample of teenage girls. To the best of our knowledge, these sub-urban schools represent a micro-cosm of the general population and a healthy mix of various socioeconomic classes. We did not recruit any subjects at hospitals or medical offices, as this approach would likely include an unhealthy population with other medical problems. Also, recruiting subjects at our headache clinic was not considered as it would lead to sampling bias due to the presence of a disproportionate number of teenagers with headache disorders.

The students received an orientation regarding the study, its mission, and its significance during a school assembly. Participation was completely voluntary and was accomplished by signing an IRB approved consent form and completing a validated survey which was designed for this purpose. Students interested in participation received a copy of the consent form, which was cosigned by their parents. Subsequently, the surveys were distributed at school during a 20 min homeroom period. The homeroom teachers administered the surveys and provided assistance to the students when necessary. The survey ascertained self-reported demographic information, including age and grade level. Due to privacy issues, we did not inquire about the students race, family income, or other medical problems.

2.1. Development of the survey

The questions were carefully selected and the survey underwent multiple revisions to ensure the comprehensibility of the questions. The response categories were scrutinized carefully to ensure the usefulness and reproducibility of the obtained information. Further validation of the questionnaire was accomplished by pretesting 15 students who gave us feedback about the clarity of the questionnaire. Based on their suggestions, the final version of the questionnaire was developed, as described below.

2.1.1. Knowledge base assessment

The first section assessed the students fund of knowledge regarding migraine. These questions were selected based on the expert opinion and consensus among the authors, and emphasized basic information about migraine. The participants knowledge base regarding migraine was assessed in five domains: epidemiology, migraine symptoms, triggers, auras and treatment options. These categories were selected based on the well-established and logical approach to the study of migraine.

In each domain except epidemiology, which included three questions, seven multiple choice questions were presented to the students. The students received credit for the questions they answered correctly in each domain. Poor knowledge was defined as answering less than one third of the questions correctly. Competence in each domain was defined as being able to answer more than half of the questions correctly. Furthermore, in order to understand the students insight into headache recognition, they were asked "to what factor they attributed their own headaches". The choices included allergies, sinus headaches, migraine headaches and non-migraine headaches.

Table 1
International classification of headache disorders second edition criteria for migraine

At least five attacks fulfilling criteria B through D
A. Headache attacks lasting 4–72 h in adults (1–72 h in children)

B. Headache has at least two of the following characteristics
   Unilateral location
   Pulsating quality
   Moderate or severe pain intensity
   Aggravation by or causing avoidance of routine physical activity (e.g., walking or climbing stairs)

C. Headache is accompanied by at least one of the following
   Nausea and/or vomiting
   Photophobia and phonophobia

D. Not attributed to another disorder

Table 2
Headache impact test six questionnaire

1. How often do you have severe headaches?
❑ Never   ❑ Rarely   ❑ Sometimes   ❑ Very often   ❑ Always
2. How often do headaches limit your ability to do usual daily activities such as school or social activities?
❑ Never   ❑ Rarely   ❑ Sometimes   ❑ Very often   ❑ Always
3. When you have headaches, how often do you need to lie down?
❑ Never   ❑ Rarely   ❑ Sometimes   ❑ Very often   ❑ Always
4. In the past four weeks, how often have you felt too tired because of your headaches?
❑ Never   ❑ Rarely   ❑ Sometimes   ❑ Very often   ❑ Always
5. In the past four weeks, how often have you felt irritated because of your headaches?
❑ Never   ❑ Rarely   ❑ Sometimes   ❑ Very often   ❑ Always
6. In the past four weeks, how often have your headaches limited your ability to concentrate?
❑ Never   ❑ Rarely   ❑ Sometimes   ❑ Very often   ❑ Always

2.1.2. Headache questions

This section inquired about any headaches the students may have experienced over the past year. The questionnaire ascertained the presence of various headache characteristics in the participants, covering all the diagnostic features of pediatric migraine as specified by the ICHD-II (Table 1). Each participant who responded affirmatively to having headaches in the past year was asked more detailed questions in regards to various headache characteristics such as severity, location, quality of pain, and migraine-associated symptoms. The response options included "never", "rarely", "sometimes", "often" and "always", the last two options were considered as affirmative. The questionnaire also collected information regarding the students' frequency of OTC medication usage.

2.1.3. Headache impact test (HIT-6)

This section evaluated the extent to which headaches placed a burden upon the students by implementing a standardized scale known as the HIT-6, a validated questionnaire used to estimate the impact of headache upon daily function (Table 2) [16]. The scale consists of six questions that cover various areas reflected in health-related quality of life, including pain, social functioning, role functioning, vitality, cognitive functioning, and psychological distress. The response to each of the questions includes five categories: "never", "rarely", "sometimes", "every often", or "always", for which 6, 8, 10, 11, or 13 points are assigned, respectively. These points are summed up to produce a total score, ranging from 36 to 78. Higher scores indicate a greater impact of headaches upon daily life. In order to further elucidate the burden of migraine, we also inquired about school absenteeism due to headaches.

3. Results

A total of 309 girls, 14–18-year-old, were recruited to the study. The results of the surveys were extracted in an Excel database. Basic statistical calculation, sorting, and filtering were performed using Excel functions. The Excel software also established the four diagnostic categories of DM, PM, non-migraine headaches and no headaches according to the ICHD-II criteria. The probability analyses (Chi-square, t-test, product moment correlation, analysis of variance [ANOVA] and Scheffe test) were done using STATISTICA software from StatSoft Inc.

Table 3
Students' fund of knowledge related to migraine

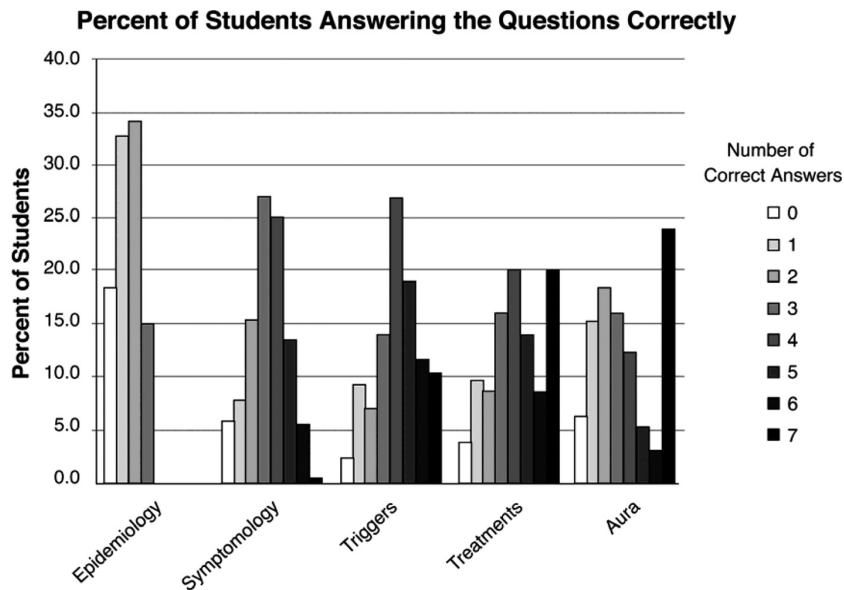| Category	Poor knowledge %	95% confidence interval	Competent %	95% confidence interval
Epidemiology	52	47–57	48	43–53
Symptoms	28	24–32	44	39–49
Triggers	19	15–23	66	62–70
Treatments	22	18–26	60	56–64
Auras	40	36–44	43	38–48

Fig. 1. Assessment of students' knowledge on migraine.

3.1. Knowledge base assessment

Figure 1 summarizes the students' fund of knowledge in the five domains of migraine epidemiology, symptoms, triggers, treatments and auras. Although 76% of the students knew an individual with migraine, many had poor knowledge about migraine. Table 3 summarizes the students' fund of knowledge with a 95% confidence interval range for each category.

3.2. Prevalence of PM and DM

Four diagnostic groups were established according to the ICHD-II criteria, as summarized in Table 4. In subjects with DM, 57% correctly identified their headaches as migraines, while only 28% of those with PM considered themselves to be migraineurs. Furthermore, 60% of students with non-migraine headaches categorized themselves correctly as non-migraineurs, while the remainder of the students attributed their headaches to allergy and sinus issues.

The majority of the subjects with DM and half of those with PM self-medicated using OTC medications. Overall, 9% of our teenagers self-medicated using the OTC's on a daily basis. Table 5 illustrates the frequency of OTC use within the various diagnostic groups. A chi-square analysis confirmed a statistically significant difference ($P < 0.001$), indicating greater medication usage among the migraineurs.

3.3. HIT-6

Table 6 summarizes the findings related to the HIT-6 scores in our study cohort. In order to compare the mean scores across the groups, ANOVA was performed, revealing statistically significant differences ($P < 0.0001$), which was confirmed by the Scheffe test. The HIT-6 scores also showed a significant correlation with school absenteeism due to headaches. The mean HIT-6 score for the students who missed school due to headaches was 60.5, compared with a mean HIT-6 score of 50.2 recorded in the rest of the students. A t-

Table 4
The prevalence of headaches in the study cohort

Observations	n (%)	95% confidence interval
Definite migraine	55 (18)	13–23
Probable migraine	79 (25)	20.5–29.5
Non-migraine headaches	139 (45)	41.5–48.5
No headaches	36 (12)	7–19

Table 5
The frequency of over-the-counter use among the different groups

Diagnosis	None	1–2 times a week	3–5 times a week	Daily
Definite migraine	8%	68%	19%	5%
Probable migraine	34%	51%	13%	2%
Non-migraine headaches	47%	48%	3%	2%

Table 6
Headache impact test six scores

Diagnosis	Mean headache impact test-6 score	Standard deviation
Definite migraine	63.0	6.0
Probable migraine	54.9	8.5
Non-migraine headache	50.1	8.0

test showed a significant difference between the means of the two groups ($P < 0.0001$). For the students who did miss at least one day of school, the product-moment correlation between their HIT-6 score and the number of days of school absence was $r = 0.34$ ($P < 0.01$). Nearly all the students who missed multiple days of school had HIT-6 scores greater than 55.

4. Discussion

Migraine represents a public health issue, which affects a significant portion of women [2]. A well-informed patient is more likely to report the relevant symptoms and receive optimal medical care. Therefore, empowering women with basic information regarding migraines may have significant impact upon their medical care. In our cohort of teenage girls, a fair number of migraineurs were able to correctly identify their headaches as migraines. However, their fund of knowledge was substantially limited in regards to migraine epidemiology and auras, and moderately limited in regards to symptoms, triggers and treatments. We propose that the materials used for educating the public must emphasize these topics, particularly treatment options, for people are intuitively disinclined to seek medical attention if they believe there are no treatments available for their condition. It must be noted that our data was obtained in group of adolescent girls and may not be applicable to the rest of the population. The other limitation of our study was the fact that it was purely epidemiological which by definition means lack of clinical confirmation of the diagnoses in the participants.

Many of the students in our cohort incorrectly attributed their headaches to allergy and sinus issues. A previous study [17] has demonstrated that this represents a common misconception among the general public, for many of these individual in fact suffer from migraines.

For a migraineur, inadequate medical care may lead to self-medication using OTC drugs. Based on OTC sales statistics [18], in the United States, about $1 billion per yr is spent on OTC medications for headaches. In our study, 9% of students used OTCs on daily basis. This pattern of behavior is often associated with medication overuse headaches [19]. We propose that public education and improving medical care for children with headache represent important steps in preventing this complication.

Previous studies conducted in Norway and Italy have reported a high prevalence of headaches of any kind among the teenagers (76% and 62%, respectively) [20, 21]. Similarly, 88% of teenage girls in our cohort reported experiencing headaches over the past year. Needless to say, our study has found a higher frequency of headaches compared to these citations due to the exclusion of boys. Also, it is important to note that participation in our study was consent based, which may have caused some selection bias. In other words, the girls suffering with headaches may have been more willing to participate in the study compared to those without headaches. This issue was unavoidable due to the IRB mandated consenting process.

In our study, the mean HIT-6 scores were significantly different between the various groups, as confirmed by ANOVA and the Scheffe test. Therefore, our data reveal that the magnitude of the HIT-6 scores parallels the phenotypic severity of headaches when comparing DM, PM and non-migraine headaches. Furthermore, HIT-6 scores correlated with the degree of headache-related disability manifested as school absenteeism. These results emphasize the effectiveness of this simple tool, as well as the importance of its implementation by pediatricians. HIT-6 is extremely user-friendly and cost effective, and is readily available on the internet.

The evolution of migraine prevalence in a group of adolescents between 9–14 years of age has been studied by Wang et al. [22], who observed a gradual increase in prevalence from 3.7% to 8.4% over a 3-year period.

Beyond this age, the evolution of migraine prevalence is poorly studied. In our study, the prevalence of DM among older teenage girls is close to the reported figure for the adult women population, suggesting a rapid increase in the disease frequency in the late teenage years.

The ICHD-II criteria for PM allows for the inclusion of a wider range of phenotypes compared with DM, and therefore, it could be expected that the prevalence of PM may be higher than that of DM, as suggested by our study. Individuals with PM tend to remain undiagnosed and untreated, as they seem to deviate from standard diagnostic criteria. Nonetheless, PM is associated with significant disability, as indicated by the HIT-6 scores, and as such deserves appropriate medical attention.

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