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Cost and Predictors of Lost Productive Time in Chronic Migraine and Episodic Migraine: Results from the American Migraine Prevalence and Prevention (AMPP) Study

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ABSTRACT

Objective: To quantify the cost differences and predictors of lost productive time (LPT) in persons with chronic migraine (CM) and episodic migraine (EM). **Methods:** The American Migraine Prevalence and Prevention (AMPP) study is a US national longitudinal survey of severe headache. Cost estimates were obtained via U.S. Census income data. To elucidate the unique predictors of LPT, the optimal distribution for modeling was determined. Zero inflation models for LPT were predicted from sociodemographics, headache features, characteristics and disability, medication use, and depression. The interaction between headache status and age was the primary effect of interest. **Results:** The eligible sample included 6329 persons with EM and 374 persons with CM. Men with CM aged 45 to 54 years cost employers nearly $200 per week more than do their EM counterparts. Likewise, for women, costs were higher for CM, with the cost differential between EM and CM being $90 per week. After comprehensive adjustment, increases in LPT with age were significantly higher in CM than in EM (rate ratio 1.03; 95% confidence interval 1.01–1.05). When age was recoded to a decade, metric rates of LPT increased 25% more per decade for CM than for EM (rate ratio 1.25; 95% confidence interval 1.004–1.5). **Conclusions:** LPT is more costly and increases more rapidly for those with CM than for those with EM as age increases.

Keywords: absenteeism, chronic migraine, cost, episodic migraine, lost productive time, migraine, presenteeism.

Introduction

Migraine is a common, disabling headache condition that is divided into two forms: episodic migraine (EM) and chronic migraine (CM) [1–3]. According to population-based studies that generally define CM by the presence of migraine in persons with headaches on at least 15 days per month, CM has a prevalence of 0.91% to 2.2% in adults [4,5], which is far lower than the EM prevalence of approximately 12% [6]. Data from studies aiming to assess and compare the epidemiological profiles of CM and EM have determined that these migraine populations are similar in that they are on average mostly female, Caucasian, with a high body mass index (BMI); however, those with CM are slightly older [7,8]. In addition, several studies have demonstrated that CM accounts for a disproportionate share of the overall disability as well as the social and economic burden associated with migraine [8–10].

Regarding the specific impact of migraine in the workplace, people with CM and EM experience significant work-related consequences [9,11]. An important marker of this impact is lost productive time (LPT). LPT estimates the per-person hours per week of productivity loss caused by reduced performance at work ("presenteeism") and absence from work ("absenteeism") due to disability. LPT is calculated as the sum of absenteeism and

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presenteeism weighted by the amount of time spent working in an average week [12,13].

Recent evidence from the American Migraine Prevalence and Prevention (AMPP) study demonstrated that among those with migraine, increased number of headache days per month accounted for increased LPT [9,11]. However, the differential age-specific impact of LPT in persons with CM and EM is not well understood. Given age variations in the prevalence between CM and EM and the variability in disease severity, understanding the relative impact of CM on the course of LPT across age is essential to characterizing CM-related burden, not just to the individual, but to society, the economy, as well as employers.

To address these issues, data from the AMPP study were utilized to quantify the corresponding per-person cost of LPT stratified on age and gender between persons with CM and EM. In addition, we modeled differences in age-based fluctuations of LPT between persons with CM and EM.

Methods

Survey and Population

The AMPP study employs a longitudinal, population-based sampling design whose two-phase methodology has been detailed elsewhere [14]. Briefly, in phase 1, a self-administered screening questionnaire was mailed to a stratified random sample of 120,000 households, selected to be representative of the US population. Households were drawn from a 600,000-household nationwide panel maintained by National Family Opinion, Inc., a survey sampling firm. Of the 162,756 respondents to the screener, 30,291 persons with useable surveys reported severe headache in their lifetime and 28,261 reported one or more severe headaches in the preceding year. A random sample of 24,000 adults ($\geq$18 years of age) with severe headache was selected to participate in phase 2: a 5-year longitudinal study with annual follow-up.

In 2005, the first year of phase 2 sampling, a total of 18,500 valid returns were obtained for respondents aged 18 years or older, and these individuals have constituted, for the most part, the AMPP panel in every year of follow-up. In 2005, as in all years, respondents completed a self-administered questionnaire assessing variables including but not limited to demographics, medical and psychiatric comorbidities, medication use and health care resource utilization for headache, and headache symptoms and characteristics, including a module designed to permit assignment of International Classification of Headache Disorders 2 (ICHD-2) diagnoses [1].

Headache Classification

The headache diagnosis module within the AMPP study has a sensitivity of 100% and a specificity of 82% for migraine diagnosis [15] and a sensitivity of 91% and a specificity of 80% for CM diagnosis [16]. The definitions of both EM and CM were based on the Silberstein-Lipton criteria [17], a variation of the definition outlined in ICHD-2R [2]. Respondents were classified as having EM if they met ICHD-2 criteria for migraine and reported headache occurring on fewer than 15 days/month on average over the preceding 3 months. Similarly, persons with CM were identified if they met ICHD-2 criteria for migraine but reported headaches an average of 15 or more days/month over the preceding 3 months.

Assessment of Variables

Variables contained within the AMPP study questionnaire considered in this analysis included demographics, headache symptoms and characteristics, acute and prophylactic medication utilization, and depression status.

Demographics included age, gender, BMI total score (calculated on the basis of the standard algorithm), average annual household income, subdivided into five categories ($<$\$22,500, \$22,500–\$39,999, \$40,000–\$59,999, \$60,000–\$89,999, and $\geq$\$90,000), education attainment (eight grades or less, some high school, high school graduate or Graduate Equivalent Diploma/General Educational Development (GED), some college or technical school, college graduate, and graduate degree), and race (Caucasian, African-American, Asian or Pacific Islander, American Indian/Aleut Eskimo, Hispanic, and other). Race was dichotomized within this analysis to contrast Caucasians against all other races.

Headache characteristics focused on allodynia, as measured by the 12-item Allodynia Symptom Checklist [18], headache-related disability as measured by the Migraine Disability Scale (MIDAS) [19], and a composite measure of migraine-related symptom severity (MSS). The validated 12-item Allodynia Symptom Checklist may be scored in multiple ways; herein, we used the diagnostic cutoff score of 3 or more [18]. MIDAS may also be scored in multiple ways; herein, we used the raw score, ranging from 0 to 270, with higher scores representing increased headache-related disability [19]. MSS scores range from 0 to 16 and are calculated by summing responses to seven items assessing ICHD-2 symptoms. These items assess unilateral pain, pulsating pain, moderate or severe pain intensity, aggravation of pain with physical activity (e.g., walking or climbing stairs), nausea, photophobia, and phonophobia, measured on a 0 to 2 frequency scale where 0 indicates absence of symptoms, 1 indicates symptoms occurring less than half the time, and 2 indicates symptoms occurring half the time or more. Summing these items and adding to it one additional item on visual aura, with values of 0 or 2, yields the MSS score having a range from 0 to 16.

Medication utilization was assessed by two large inventories of medication use for headache, one for acute medications and another for prophylactic medications. Acute medication users were identified on the basis of self-report of current use of any nonsteroidal anti-inflamatory drug, triptan, ergotamine, barbiturate, or opioid. Prophylactic medication use was defined on the basis of endorsement of a single item assessing current preventive medication use for headache or self-report of use of any drug classified within the AMPP study as a prophylactic compound including depakote, neurontin, topomax, cymbalta, effexor, elavil, pamelor, paxil, fluoxetine (Prozac), sertraline (Zoloft), blocadren, calan, covera-HS, isoptin, corgard, inderal, lopressor, toprol XL, procardia, tenormin, and botulinum toxin.

Depression was assessed through responses to the PRIME-MD Patient Health Questionnaire-depression module [20], a validated measure of current major depressive disorder based on *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition,* criteria [21]. Following PRIME-MD guidelines, a score of 10 or more was used to define major depressive diagnosis.

Respondents were also asked about current employment status. Response options included working for pay full or part time, unemployed, retired, a student, a homemaker, disabled, a volunteer, on medical or maternity leave, or "other." In addition, respondents completed the Work and Health Questionnaire (WHQ) [12,13], a 17-item, self-administered questionnaire that assesses usual number of hours worked/week, number of missed workdays in the preceding 2 weeks ("absenteeism"), days at work not feeling well and reduced work performance ("presenteeism"), and reasons for absenteeism and presenteeism. Absenteeism and presenteeism estimates were based on responses to six questions and a previously validated weighting and scoring method [11–13,22]. LPT estimates were based on a weekly average self-report of hours