^aDepartment of Epidemiology, Johns Hopkins School of Public Health, Baltimore, Md., ^bDepartments of Neurology, Epidemiology and Social Medicine, Albert Einstein College of Medicine, Headache Unit, Montefiore Medical Center, New York, N.Y., USA

The Economic and Social Impact of Migraine

Key Words
Migraine
Socio-economics
Disability
Pain intensity

Abstract
Migraine is an episodic disorder which is often disabling both during and between attacks. While pain intensity is the most important symptom to individual sufferers, headache-related disability is the major determinant of the economic impact of illness. Because migraine is underdiagnosed and under-treated, cost-effective healthcare interventions could serve to reduce the burden of illness on individual sufferers and society. Measures which assess both pain intensity and disability might serve to capture the essential elements of migraine and provide the basis for effective healthcare interventions.
Walter F. Stewart, Department of Epidemiology, School of Hygiene and Public Health, The Johns Hopkins University, 615 N Wolfe Street, Baltimore, MD 21205 (USA)

Introduction
Migraine not only causes suffering for individuals; it also has an impact on society. This impact on society can be expressed in economic terms. The economic costs of migraine arise from both direct costs (medical care etc.) and indirect costs such as missed work and disability at work. To characterize the impact of migraine on society, it is necessary to understand first the impact of migraine on the individual. Measures of disability provide a link between the impact of migraine on the individual and the impact on society. Ultimately, an accounting of the economic impact of migraine can be used to assess the value of effective diagnosis and treatment.

Table 1. Proportion of migraine sufferers with selected associated symptoms

Migraineurs affected (%)	
Females	Males
72	60
28	21
72	66
83	84
59	51
31	31

Estimated from data taken from the American Migraine Study [1,22].

Impact of Migraine on the Individual

Migraine is a chronic condition with episodic attacks. The acute attack, the most obvious aspect of the illness, is characterized by pain, nausea, vomiting, sensitivity to light, sound and odours and, in some cases, visual disturbances known as auras [1-6]. No single feature is absolutely required for diagnosis. Chronic aspects of migraine are characterized by how the condition changes an individual's behaviour and induces disability between attacks. Table 1 profiles the proportion of people who meet the International Headache Society (IHS) [7] case definition

Table 2. Results of selected studies of n intensity from migraine [3-5,8] Mild Moderate Severe Veryneurs

Study	No. of	Location	Sufferers reporting pain intensity, %				
Henry et al. (1992) [3]	340	France	7	19	48	26	
Lin et al. (1989) [5, 8] ^a	1382	USA	11	31.1	30.3	26.8	
Rasmussen et al. (1991) [4]	119	Denmark	1	14		85	

^a Authors' classification modified to fit this scheme; personal communication. In these studies pain intensity was assessed by a variety of methods: interval scales [3]; anchored scale [5, 8]; mixed scale [4].

for migraine who experience particular symptoms. Throbbing pain is the most common symptom, occurring in 83% of females and 84% of males. The least common symptom is vomiting, occurring in about one quarter of migraine sufferers.

Though attacks vary from person to person, the majority of migraine sufferers report that pain is the most important symptom and that pain relief is their most important motivation for seeking care. Across several studies (table 2) [3-5, 8], 57-85% of migraine sufferers report that they experience severe or very severe pain. The assessment of pain intensity has received much attention, but there are inherent difficulties in devising scales of measurement. Interval, anchored and mixed scales have been used [3-5, 8]. In interval scales, a range of scores is used in which each unit is qualitatively characterized by an increasing degree of severity, but no attempt is made to give points of reference for each score. Anchored scales, on the other hand, define the lowest and highest scale values. The mixed scales score pain intensity in terms of a graded measure of interference with activities. This has the advantage of providing scale points that are intuitively meaningful, but has the disadvantage that in some individuals disability is not the result of pain but of other migraine symptoms.

Several population-based studies have used either simple ordinal [3-5, 8], interval or anchored pain scales. These studies show that 57-85% of migraineurs reported severe or very severe pain with their attacks. Since the IHS case definition uses moderate or severe pain intensity as one possible diagnostic criterion it is not surprising that pain intensity levels are high [9].

While migraine is often characterized as an episodic condition, features of the illness often extend beyond the acute attack. At the biological level, there is an enduring predisposition to attacks which may take the form of a reduced threshold to the development of headaches [10]. At the psychosocial level, there may be changes in behaviour, long-term adoption of the sick-role with disruption at work, school or in social roles [11-13]. The higher prevalence of migraine in low income groups in the USA may be a consequence of this long-term disruption [1, 14, 15]. Thus, migraineurs report substantial disruption of their lives. In a Canadian population-based study [6], 77% of migraineurs reported a limited ability to function normally during their last attack, 50% had to discontinue normal activity, 30% required bed-rest and about 30% had to cancel family or social activities. Though 30% of migraineurs required bed-rest with their attack, only 19% reported missing work. This may indicate that people with migraine work through severe headaches at a reduced level of productivity, and then go home and go to bed.

The impact of migraine on quality of life has been assessed using the Study Short Form 36 (SF-36) from the Medical Outcomes Study (MOS). This questionnaire was administered to 845 referral clinic patients with IHS-diag-nosed migraine [16]. The SF-36 questionnaire is a well validated questionnaire for assessing quality of life. It is designed to gather information on a range of factors that affect quality of life, including functional status, well-being, and perception of overall health status. With the exception of scores for physical functioning and health perceptions, quality of life scores for migraineurs (fig. 1) were low in comparison with those for patients with other chronic conditions (diabetes, hypertension, angina) [17]. Similar results have been found in a more recent study comparing the quality of life impact of migraine with that of osteoarthritis or congestive heart failure [18]. A limitation of both of these studies [17, 18] is that the patients were recruited from referral clinics. Such patients represent those with more severe migraine and may not be representative of the general migraineur population.

13
Economic Impact

Fig. 1. SF-36 quality of life profiles for migraine patients in comparison with those for patients with other chronic conditions. Adapted with permission from Osterhaus and Townsend [16] and Stewart et al. [17].

number of studies have examined the direct or indirect costs of migraine [19-21]. Several studies quantified the

use of healthcare resources such as emergency-room visits, clinic visits, hospitalization or drugs, but monetary values were often not estimated. Table 3 summarizes the available data on costs of healthcare for migraine. About 13% of migraineurs use emergency rooms [21], 56-71% use general medical services and 16-41% consult specialists. Only Osterhaus et al. [20] attempted to quantify the economic value of these services. Most studies of indirect cost emphasize the proportion of migraine sufferers who miss at least 1 day of work per year. Estimates range from 19-43% [6, 11, 13]. Several studies estimate the number of work days lost per year, per migraineur or to the employed population. Few studies attempt to compute the economic value of missed work or of impairment at work. A summary of recent data on indirect costs, modelled after the work of de Lissovoy and Lazarus [19], is shown in Table 4. In the American Migraine Study, the number of work days missed (defined as both paid and household work) per year as a result of severe migraine attacks was assessed.

Table 3. Summary of published findings related to direct costs

Cost-of-illness component Study		
Migraineurs who used services Males,% Females,% Total,%		
<i>Use of Medical Services</i>		
Emergency room care		
General medical attention		
Specialist		
Hospitalization Prescription medication		
Over-the-counter medication Medication (general)		
Celentano et al. [28] Edmeads et al. [11] Edmeads et al. [11] Green [29] Rasmussen et al. [13] Stang and Osterhaus [14] Edmeads et al. [11] Rasmussen et al. [13] Stang and Osterhaus [14] Celentano et al. [28] Edmeads et al. [11] Celentano et al. [28] Edmeads et al. [11] Rasmussen et al. [13]		
13.4	13.4	13.4
-	-	14.0
-	-	64.0
66.3	73.5	71.1
43.0	61.0	56.0
77.0	85.0	-
-	-	41.0
17.0	16.0	16.0
6.2	8.4	7.0
28.3	40.1	-
-	-	44.0
66.9	56.8	-
-	-	91.0
35.0	56.0	49.0
(Cost/patient per year)		
<i>Value of medical services</i>		
Emergency room visits Clinic visits Hospitalizations		
Osterhaus et al. [20] Osterhaus et al. [20] Osterhaus et al. [20]		
\$281	\$148	
\$387		
Reprinted with permission from de Lissovoy and Lazarus [19].		

US[14] sample survey) by physician

Rasmussen et al. (1992)	Community	In person	740	IHS 1988
Denmark				
Ever consulted a physician for migraine				
Ever hospitalized for treatment				
Projected restricted activity among employees (days/year)				
Projected restricted activity among housewives (days/year)				
Projected lost productivity due to migraine				
16.1 % Used medication for migraine in the last year				
Ever consulted a general practitioner for migraine				
Ever consulted a specialist for migraine				
Employed who missed 1 or more days of work annually				
77% 85%				
7.0% 21.5				
6.2% 8.4%				
2.7 18.8				
38.5 \$ 1.4 billion/year among 6.2 million migraineurs				
35% 56% 49%				
43% 61% 56%				
17% 16% 16%				
32% 43% 43%				

IHS = International Headache Society; NCHS = National Center for Health Statistics; OTC = Over-the-counter. Reprinted with permission from de Lissovoy and Lazarus [19].

Fig. 2. Relationship between disability and (a) pain intensity and (b) number of migraine symptoms. Data are from patients questioned about a headache that had occurred in the previous 7 days, and are for female migraineurs only; findings for male migraineurs were similar. Disability is defined as missing all or part of a work or school day. Reprinted with permission from Stewart et al. [8].

Washington County, Maryland [5, 8]. The relationship between disability and pain intensity was examined for the most recent headache attack for each subject if it occurred within 5 days of interview. Disability was rated as none, partial or complete loss of a work or a school day. Pain intensity was rated on a 0-10 scale where 0 was no pain at all and 10 was very severe pain. We present data only on females although findings were similar for males [5]. These data are presented in graphic form based on a model developed using regression methods. The results show that as pain intensity increases the proportion of migraine sufferers with disability also increases. For subjects with pain intensity of 10, over 60% are disabled for all or part of the day (fig. 2a). A similar pattern is observed with number of symptoms (fig. 2b) [8]. Using different methods, Von Korff and co-workers have examined the relationship between pain intensity and disability [23,24]. Their work demonstrates a hierarchical relationship between pain intensity and disability, suggesting that a certain level of pain is required for disability. Using a self-administered questionnaire Von Korff et al. [23] classified headache sufferers presenting to a Health Maintenance Organization (HMO) into four grades. At lower severity grades (grades I and II) patients were differentiated by pain intensity. Grade I patients have mild or moderate pain; grade II patients have more severe pain; while at the higher grades (grades III and IV) patients are differentiated by the extent of interference with their daily activities. Von Korff et al. [23] have shown that headache grade is strongly associated with both direct and indirect costs of illness. They evaluated and followed 740 patients presenting to an HMO and complaining of headache. They showed that as headache grade increased the total cost of headache treatment also increased, as determined from the HMO healthcare records. Costs of headache treatment for 1 year were approximately \$200 for grade I patients and about \$800 for grade IV patients. Headache grade also predicted aspects of the indirect costs of migraine. At the baseline assessment, roughly 5% of grade I and II patients were unemployed, approximating regional population rates. For grade III patients, baseline unemployment was 10% and for grade IV patients it reached 20%. In addition, patients at grades III and IV maintained high levels of unemployment during a 2-year follow-up period. Thus, a simple test at cross-section can predict important aspects of direct and indirect costs at follow-up assessment. This measure of severity of an illness, which combines information on disability and pain intensity, promises to provide a clinically relevant measure of ‘migraine severity’ or migraine impact which will predict impaired ability to work and to function in other roles, prognosis and general well-being. Such a measure should aid the identification of those migraineurs in need of care and assess the benefits of treatment.

Implications

Though migraine has an important impact on individual sufferers and on society it is substantially underdiagnosed and undertreated [6, 8, 11, 13, 22]. Stang et al. [21] have summarized data indicating that most migraineurs do not currently consult doctors for their headaches; those who do consult often receive suboptimal treatment. As many of the migraineurs not receiving care experience substantial levels of pain and disability, and as migraine often responds to medical therapy, it follows that im-

16
Stewart/Lipton
Socio-Economic Impact of Migraine

provements in healthcare delivery might substantially reduce the individual and economic impact of this illness [25]. For these efforts to be cost-effective, treatment must reduce disability and relieve pain to a degree which offsets the costs of intervention. Though disability has not been a typical endpoint in migraine clinical trials, recent double-blind studies have demonstrated that treatment can reduce disability or restore normal function [26, 27]. Thus, intervention is most likely to be cost effective if it is directed to the migraine sufferers whose illness has the greatest impact [24]. The recent studies of Von Korff et al. [23, 24] show that the headache sufferers reporting severity grades III and IV accounted for a disproportionate share of direct and indirect costs. This work provides a rationale for the development of a Migraine Impact Measure for use in clinical practice [25]. Ideally, such a measure would help identify the migraineurs most in need of care, predict prognosis at the time of an initial assessment and provide a yardstick for monitoring improvement in clinical trials and clinical practice.

Acknowledgement

The authors are grateful to Dr Michael Von Korff, Sc.D, of the Center for Health Studies, Puget Sound, Washington, USA, for providing data used in this review, and for helpful discussions of these issues.

References

1 Stewart WF, Lipton RB, Celentano DD, Reed ML: Prevalence of migraine headache in the United States: relation to age, income, race, and other sociodemographic factors. JAMA 1992;267:64-69.
2 Ekblom K, Ahlborg B, Scheie R: Prevalence of migraine and cluster headache in Swedish men of 18. Headache 1978;18:9-19.
3 Henry P, Michel P, Brochet B, Dartigues JF, Tison S, Salamon R and the GRIM: A nationwide survey of migraine in France: prevalence and clinical features in adults. Cephalalgia 1992;12:229-237.
4 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.
5 Linet MS, Stewart WF, Celentano DD, Ziegler D, Sprecher M: An epidemiological study of headache among adolescents and young adults. JAMA 1989;261:2211-2216.

6 Pryse-Phillips W, Findlay H, Tugwell P, Edmeads J, Murray TJ, Nelson RF: A Canadian population survey on the clinical, epidemiological and societal impact of migraine and tension-type headache. *Can J Neurol Sci* 1992; 19: 333-339.

7 Headache Classification Committee of the International Headache Society: Classification and diagnostic criteria for headache disorders, cranial neuralgias and facial pain. *Cephalalgia* 1988;8(suppl 7):19-28.

8 Stewart WF, Schechter A, Lipton RB: Migraine heterogeneity: disability, pain intensity and attack frequency and duration. *Neurology* 1994; 44(suppl 4):24-39.

9 Von Korff M, Dworkin SF: Problems in measuring pain by survey: the classification of chronic pain; in Chapman CR, Loeser J (eds): *Issues in Pain Measurement*. New York, Raven Press, 1989, pp 519-533.

10 Welch KM: A: Migraine: a biobehavioral disorder. *Arch Neurol* 1987;44:323-327.

11 Edmeads J, Findlay H, Tugwell P, Pryse-Phillips W, Nelson RF, Murray TJ: Impact of migraine and tension-type headache on lifestyle, consulting behaviour and medication use: a Canadian population survey. *Can J Neurol* 1993;20:131-137.

12 Rasmussen BK, Jensen R, Olesen J: A population-based analysis of the diagnostic criteria of the International Headache Society. *Cephalalgia* 1991;11:129-134.

13 Rasmussen BK, Jensen R, Olesen J: Impact of headache on sickness, absence and utilization of medical services: a Danish population study. *J Epidemiol Community Health* 1992;46:443-446.

14 Stang PE, Osterhaus JT: Impact of migraine in the United States: data from the National Health Interview Survey. *Headache* 1993;33: 29-35.

15 Lipton RB, Stewart WF. Migraine in the United States: A review of epidemiology and healthcare use. *Neurology* 1993;43(suppl 3): 6-10.

16 Osterhaus JT, Townsend RJ: The quality of life of migraineurs: a cross-sectional profile. *Cephalalgia* 1991;11(suppl 11):103-104.

17 Stewart AL, Greenfield S, Hays RD: Functional status and well-being of patients with chronic conditions: results from the Medical Outcomes Study. *JAMA* 1989;262:907-913.

18 Osterhaus JT: The burden of migraine. *Can J Neurol Sci* 1993;20(suppl 4):35.

19 de Lissovoy G, Lazarus SS: The economic cost of migraine: present state of knowledge. *Neurology* 1994;44(suppl 4):56-62.

20 Osterhaus JT, Gutterman DG, Plachetka JR: Healthcare resource and lost labour costs of migraine headache in the US. *Pharmacoeconomics* 1992;2:67-76.

21 Stang PE, Osterhaus JT, Celentano DD. Migraine: Patterns of healthcare utilization. *Neurology* 1994;44(suppl 4):47-55.

22 Lipton RB, Stewart WF, Celentano DD, Reed ML: Undiagnosed migraine: A comparison of symptom-based and self-reported physician diagnosis. *Arch Int Med* 1992;152:1273-1278.

23 Von Korff M, Ormel J, Keefe FJ, Dworkin SF: Grading the severity of chronic pain. *Pain* 1992;50:133-149.

24 Von Korff M, Stewart WF, Lipton RB: Assessing headache severity: new directions. *Neurology* 1994;44(suppl 4):40-46.

25 Lipton RB, Amatriek JC, Ferrari MD, Gross M: Migraine: identifying and removing barriers to care. *Neurology* 1994;44(suppl 4):63-68.

26 Cady RK, Wendt JK, Kirchner JR, Sargent JD, Rothrock JF, Skaggs H: Treatment of acute migraine with subcutaneous sumatriptan. *JAMA* 1991;265:2831-2835.

27 Ferrari MD for the Subcutaneous Sumatriptan International Study Group: Treatment of migraine attacks with sumatriptan. *N Engl J Med* 1991;325:316-321.

28 Celentano DD, Stewart WF, Lipton RB: Medication use and disability among migraineurs: a national probability sample survey. *Headache* 1992;32:223-228.

29 Green J: A survey of migraine in England 1975-1976. *Headache* 1977;17:67-68.

30 Chicoye A, Auray JP, Duru G: The burden of migraine in France; in Chytil MK (ed): *Proceedings of the Fifth International Conference on System Science in Health Care*. Prague, Omnipress, 1992, pp 1554-1559.

31 Cull RE, Wells NEJ, Miocevich ML: The economic cost of migraine. *British Journal of Economics* 1992;2:103-115.

17
Symptom
Nausea Vomiting Photophobia Throbbing pain Unilateral pain Visual aura