

Epidemiology of Migraine

Based on a presentation by Walter F. Stewart, PhD, MPH

Presentation Summary

About one of every nine individuals in the United States suffers from migraine. Prevalence peaks between 20 and 50 years of age, and females are about three times more likely than males to have migraines. Severe disability is a hallmark of the disease but is primarily concentrated in a minority of migraine sufferers. Less than half of the migraine population

accounts for almost 90% of the lost work time. Strategies aimed at targeting treatment to those most in need of care are likely to reduce a significant proportion of the indirect costs associated with migraine. Screening tools, combined with a spectrum of effective therapies and pain management strategies, should increase opportunities to improve outcomes in this population.

Migraine affects about 1 of every 9 individuals.¹ This chronic episodic condition is characterized by its intense and disabling pain and associated symptoms. The costs to both individuals and society can be high. However, in the United States, Canada, and Europe, migraine continues to be underdiagnosed and undertreated. In the United States, about 6 of every 10 women and 7 of every 10 men with migraine report that they have never been diagnosed.²

In this review, epidemiologic data are summarized to provide an understanding of the spectrum of migraine and its individual and societal consequences.

How Many Migraines?

The prevalence of migraine—that is, the proportion of a population that has migraine over a specified period of time—provides valuable information about the extent of the disease in the population and lays the foundation for understanding the societal burden in terms of direct and indirect costs. With diseases of long duration, such as migraine, the prevalence tends to be high.

One researcher in Denmark has established the lifetime prevalence of several distinct headache disorders in that country. While approximately 78% of the population reported tension-type (sometimes called “muscle

contraction”) headache at some point in their life, 16% of the study population reported having had a migraine.³ The lifetime prevalence was calculated to be 15% for sinus headaches, 4%

for head trauma headaches, and 0.5% for nonvascular intracranial disease.⁴

The 1-year period prevalence is one of the most commonly reported indicators of disease burden. With the introduction of the International Headache Society (IHS) criteria for migraine diagnosis in 1988, migraine could finally be consistently defined from study to study. The extreme variations in the pre-1988 prevalence data had led many clinicians to dismiss the headache diagnosis as “too subjective” and therefore unworthy of attention. Today, the combination of these post-1988 prevalence statistics based on solid diagnostic criteria, together with the new treatment options, are making migraine a new priority in many clinical settings.

Three key studies of 1-year migraine prevalence—studies conducted in three different countries—provide remarkably consistent results (Figure 1). These studies in Denmark, France, and the United States document a prevalence of about 6% for males and 15% to 17% for females.^{1,4,5}

When these 1-year prevalence data are combined with information on 1-year incidence (ie, new cases) of migraine, the average duration of migraine disease can be estimated at 10 to 20 years.

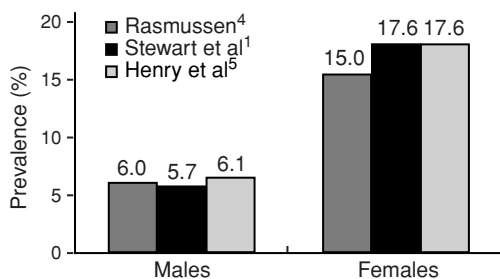
Projecting the single-study prevalence findings to the overall US population, our 1990 study predicted that there were about 18 million females and 5.6 million males with severe migraine.¹ Of this total, there were estimated to be 8.7 million females and 2.6 million males with moderate or severe disability due to migraine.

The Peak Years for Migraine

The indirect costs to society of these 11 million disabled individuals are extremely high. The reason for these high societal costs becomes clear when analyzing the age distribution patterns seen with migraine disorders.

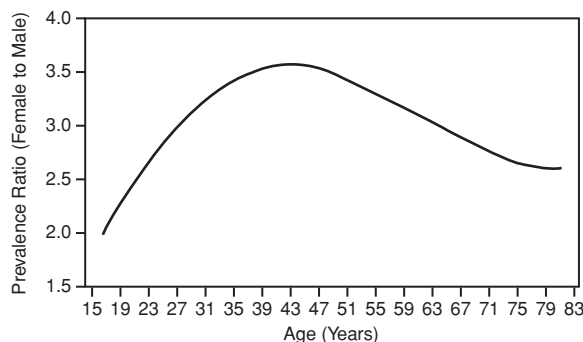
Migraine headaches typically begin around the age of 10 or 11 in boys and

Figure 1. Prevalence of Migraine (1-Year)



Sources: See reference 1, 4, and 5.

Figure 2. Prevalence by Age (1-Year)



Source: See reference 7.

about 5 years later in girls.⁶ This peak age of onset in childhood or adolescence means that family practitioners or pediatricians may have the first opportunity to diagnose this chronic disorder.

At a young age, migraine prevalence is similar for boys and girls. After puberty, migraine becomes considerably more common in females, with the overall peak 1-year prevalence occurring around age 38 to 40 for both males and females (Figure 2).⁷ It is the demographic surge in migraine attacks between the ages of 20 and 50—the peak productivity years for most individuals—that accounts for increased indirect costs for migraine.

Who Gets Migraines?

One of the most striking and consistent demographic features of migraine is its excess prevalence in the female population. This feature can be expressed as the gender ratio: the prevalence of migraine in females divided by that of males at different ages. A gender ratio of 1 means that the prevalence is the same in both groups. The female-to-male ratio for migraine after age 15 is always above 2 and peaks at about 3.5 at age 40.⁷ This large increase in gender ratio at middle age is not unexpected, but even after menopause the ratio remains above 2, suggesting constitutional factors that go beyond differences in circulating hormones.

Hormonal triggers probably play some role in the female propensity for migraine.⁸ Our study of about 100 female migraineurs found an excess risk of migraine on days 0, 1, and 2 of the menstrual cycle.⁸ However, the excess was not as high as one might expect. While migraine headaches would be expected to occur at random on these 3 days about 10% of the time, we found the prevalence to be 15%, only slightly elevated. These findings, plus the continuing high

gender ratio after menopause, suggest that hormonal triggers may have more impact on increasing the seriousness of migraine attacks than in actually initiating attacks.⁹

Little scientific work has evaluated the role of other potential migraine triggers such as foods (eg, chocolate, cheeses), stress, and food additives. Although often discussed by physicians and patients, much work remains to be done in identifying triggers and susceptibility factors before useful guidelines can be adopted.

Comorbidities

Studies within the United States have shown migraine prevalence differs considerably by race. Caucasians have the highest rates followed by African Americans (prevalence ratios of 0.73 and 0.76 for females and males, respectively, compared to Caucasians) and Asian Americans (0.49 and 0.60 for females and males, respectively, compared to Caucasians).¹⁰ This pattern generally mirrors that seen when results from separate international epidemiologic studies are compared,^{1,3,11} although the rates in Asia and Africa are even slightly lower than those seen in the same race groups in America.¹²⁻¹⁴ Thus, although environmental factors in Western societies may play a role in increasing rates of migraine, genetic factors also seem to be involved.

Income has also been correlated with migraine prevalence. Contrary to beliefs held years ago when migraine was associated with affluence, data from large surveys show that migraine prevalence actually goes down as income goes up.^{1,7,15} In females, for instance, the prevalence ratio decreases from 1.0 in those with a household income less than \$10,000 per year to 0.79 in those earning up to \$20,000, to 0.69 in those earning up to \$30,000, and to 0.59 in those earning up to \$45,000.⁷ The trend is similar for males and has been repeated in other US studies.

The potential causes for the association between lower income and higher rates of migraine are, at this point, speculative. One explanation involves an increased exposure to stress, dietary, or environmental triggers in lower-income populations. Another explanation involves a “downward drift phenomenon, a psychiatric term that refers to the gradual economic slide of an individual due to a disabling condition, in this case migraine.¹ Better access to quality medical care in the higher income groups may also explain part of the pattern.

The level of disability associated with migraine may have genetic underpinnings. We evaluated genetic factors in both the United States and the United Kingdom by interviewing a population of migraineurs about their levels of disability and then collecting information on the prevalence of migraine within the family of the migraineur. Family members of individuals with high disability had a prevalence of migraine that was almost 2.5 times higher than the prevalence seen in families of migraineurs with mild or moderate disability.¹⁶ Thus, there may be a genetic subtype of migraine that is more disabling. Some studies have suggested a higher risk of autonomic nervous system dysfunction and calcium channels in this subtype of disease.¹⁷ Alternatively, there may be an environmental subtype that is less disabling.

Where Is Disability Highest?

Disability associated with migraine remains one of this condition’s defining characteristics. A recent epidemiologic review showed that approximately one third of people who experienced migraine felt disability severe enough to require bedrest.⁷ Fully half of both males and females in this study reported moderate disability in which productivity at work was substantially

reduced. About 4 of every 5 undiagnosed migraineurs experience some level of headache-related disability.²

In an effort to improve monitoring of disability, we developed a patient-friendly disability scoring system called MIDAS (Migraine Disability Assessment Programme, copyright 1997, Innovative Medical Research) (Figure 3). This self-scoring questionnaire allows us to measure lost time at work and in performing other tasks such as household chores and school or social activities. All these practical adverse outcomes are incorporated, along with the frequency and severity of the pain itself, into an overall disability score.

Implications for Therapy

The data of the past 10 years document migraine as an underreported and undertreated condition in health-care today. The economic costs associated with these headaches have only recently come to light.

High disability rates associated with migraine have direct implications for healthcare systems currently evaluating clinical protocols and management options. In particular, organizations with information systems and clinical practice guidelines that allow targeting of specific member populations for migraine treatment may be able to show substantial gains in reducing costs associated with this condition. This is because a specific subset of the migraine population actually requires the majority of care.

To define this subset, we plotted the cumulative distribution of migraine cases against the percentage of the total workday loss due to migraine.¹⁴ Rather than an even distribution, we found that about 50% of the migraineurs accounted for over 90% of lost work time. These data support a strategy aimed at targeting those most in need of care in order to reduce direct and indirect costs attributable to uncontrolled migraine.

Figure 3. MIDAS (Migraine Disability Assessment Programme) Questionnaire

INSTRUCTIONS: Please answer the following questions about **ALL** the headaches you have had over the last 3 months. Write your answer in the box next to each question. Write zero if you did not do the activity in the last 3 months. (Please refer to the calendar below, if necessary.)

1. On how many days in the last 3 months did you miss work or school because of your headaches? days
2. How many days in the last 3 months was your productivity at work or school reduced by half or more because of your headaches (*Do not include days you counted in question 1 where you missed work or school*)? days
3. On how many days in the last 3 months did you **not** do household work because of your headaches? days
4. How many days in the last 3 months was your productivity in household work reduced by half or more because of your headaches (*Do not include days you counted in question 3 where you did not do household work*)? days
5. On how many days in the last 3 months did you miss family, social, or leisure activities because of your headaches? days
 - A. On how many days in the last 3 months did you have any headache? (If a headache lasted more than one day, count each day) days
 - B. On a scale of 0 - 10, on average how painful were these headaches? (0 = no pain at all, and 10 = pain which is as bad as it can be)

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Source: Innovative Medical Research, Towson, Maryland.

Increased initial investments in direct treatment will be needed to make these longer-term gains. Although proof of a return on such investment remains to be established, the diagnostic and pharmacologic tools for such a study are now available.

In years to come, the relationship between migraine and various comorbid conditions may impact treatment decisions. Some evidence suggests, for example, that epilepsy and stroke occur more frequently in individuals with migraine.¹⁸⁻²⁰ While depression also appears to be comorbid with migraine, it is not known if depression causes migraine or vice versa.²¹ Evidence for comorbidity of migraine with anxiety disorders is even stronger.²² Less well studied but suspected of being comorbid are conditions such as manic-depressive illness, mitral valve prolapse, and Raynaud's syndrome.

Many questions regarding the pathophysiology and epidemiology of migraine remain. However, the evidence for extremely high levels of disability in the migraineur population is clear. Unfortunately, a substantial portion of individuals who experience the most disabling migraine attacks still do not receive care or have not even had a diagnosis. Further, for many of those with the most disabling migraines, treatment has been unsatisfactory, and so they stop seeking care.

With the improved diagnostic tools and the range of effective therapies available to practitioners today, targeting this high-pain, high-cost group for intervention should become a priority for the next decade.

... DISCUSSION HIGHLIGHTS ...

Dr. Brown: On the MIDAS tool, why is there no question about whether or not patients sought medical care or had taken medication for the headache? Some people subjectively believe they do not have reduced pro-

ductivity on the job, but they are still seeing a doctor or taking drugs.

Dr. Stewart: We had questions such as that in an earlier version of the questionnaire. But our focus groups with clinicians kept telling us to keep it simple and easy to score. We wanted the questionnaire to be like the Apgar score or blood pressure measurement, intuitive and easy to measure, so we focused on the severity dimension.

Dr. Parham: We often use quality-of-life instruments such as the Short Form 36 or the abbreviated Short-Short Form 12 to monitor the effectiveness of therapies. For some diseases, like rheumatoid arthritis, we have disease-specific tools. Do we have a tool for measuring migraine burden of illness over time?

Dr. Stewart: My colleagues and I actually set out to develop a migraine-specific tool for long-term monitoring. We developed one that was highly reliable, very accurate compared to diary measures and so forth, but it was not clinically useful. It was too complex. That is how we arrived at the MIDAS tool, which we have shown to be valid, reliable, intuitive, and easy to use. This is now in the public domain.

Dr. Mondell: I believe the MIDAS instrument you describe will be extremely useful in helping practitioners determine the proper level of care. It still needs to be validated, but it appears to be user-friendly and should help in quantifying outcomes of various treatments. Also, in managed care, MIDAS might help at the screening level in terms of early decision points in the treatment protocol.

Dr. Johnson: One caution: I think clinicians need to be careful about over-reliance on questionnaires of this type. Most of us know that it usually

takes several visits to get the complete patient story, the full story, on migraine.

Dr. Stewart: I agree that the patient-physician interaction is irreplaceable.

Dr. Johnson: My other caution about using such a tool would be that it might lead us to neglect those whose quality of life is greatly reduced, but who are still functioning, still pushing on, still going to work. The vast majority of patients are in this category.

Dr. Stewart: That's why we have the question about reduced productivity at work, to capture that element you are worried about. This practical information can be important, when fed back to physicians, in changing their perception of their patient.

Dr. Brown: As a patient-rated screening device, MIDAS could be important in educating patients about their headaches. They are often unsure of their own diagnosis. But do we have any simple migraine screening tools for primary care physicians? In common disorders such as depression, physician-rated tools have become very important in screening.

Dr. Mondell: The International Headache Society classification guidelines were originally developed not just to ensure uniformity in research trials but also to assist in clinical practice. These criteria can be reduced to a very simple checklist, and in fact these checklists have been used in telephone surveys to measure migraine prevalence.

Dr. Ward: Are the simplified criteria widely available? In my practice, I meet many specialists who are unaware of the features of migraine. They treat this head pain as something else: an ENT as a sinus headache, a dentist as temporomandibular joint, and the chiroprac-

tor as something else entirely. If doctors or even patients can access this information more easily, proper treatment can start earlier.

Dr. Mondell: The tools have been published²³ in a simplified form for patient self-help, and they are even available on some Internet websites

“As a patient-rated screening device, MIDAS could be important in educating patients about their headaches.”

—Candace S. Brown, PharmD

sponsored by the industry. (For example, <http://www.migrainehelp.com>) And these easily available tools can go a long way toward improving diagnosis. About 45% to 50% of those with migraine are not formally diagnosed. And if they do consult physicians, the care is often misguided, whether it be treatment for sinus headache from an ENT or manipulations from a chiropractor.

Since we are now blessed with a whole host of effective treatment options, it is a shame to waste time with a missed diagnosis.

Dr. Gallagher: We cannot assume that the average family practitioner is as uneducated as he or she used to be about headache. In my region, headache is one of the top 10 complaints, and most primary care providers do an adequate job in treating and referring.

Dr. Ward: I agree that the trend is positive. Attendance at meetings such as the American Association of Headache and the National Headache Foundation

has more than tripled in 3 years. Many of these are primary care doctors who stay for the whole conference.

Dr. Mondell: My point is that we cannot stop at these educational efforts. We need to increase the depth of the continuing medical education that is presented.

“The false positive is another diagnostic inaccuracy that can needlessly and expensively extend care. The patient who reads about migraine in the popular press and self-diagnoses can waste much money on ineffective or dangerous treatments.”

—Stuart O. Schweitzer, PhD

Dr. Lake: How much information do we have on the 3% to 5% of the population with frequent headaches?

Dr. Stewart: The epidemiology is new and limited. We know that in specialty care centers, these frequent headache sufferers account for a significant share of physician time, but we have not defined this.

Dr. Mondell: People with frequent persistent headaches, though clearly a minority of the total migraine population, are the ones with the poorest outcomes. If we can identify these individuals and provide the proper diagnosis, care, or referral, we can prevent not only the suffering and dissatisfaction but also the money spent on alternative cares, whether herbal, nutritional, or chiropractic, that have little scientific validation.

Dr. Schweitzer: The false positive is another diagnostic inaccuracy that

can needlessly and expensively extend care. The patient who reads about migraine in the popular press and self-diagnoses can waste much money on ineffective or dangerous treatments.

Dr. Mondell: The growth in patient education and consumer marketing has implications for clinicians. The first is that more patients are getting validation for their pain. They are talking to their physicians, and they are often coming in with patient diaries. These diaries are now available from a variety of patient-focused organizations such as the American Council on Headache Education, (telephone—800-225-2243; website—<http://www.achenet.org>) and the National Headache Foundation (telephone—800-843-2256; website—<http://www.headaches.org>). The second implication of patient education is, as Dr. Schweitzer mentions, that more patients may be self-medicating. Over-the-counter [OTC] pain relievers, such as a caffeine-acetaminophen-aspirin combination preparation, can be safe and useful when used properly. In people with recurring severe headaches, these drugs are, all too often, misused or overused, and the result is analgesic rebound headache. Additionally, the potential for gastrointestinal, hepatic, or renal complications of heavy OTC analgesic is well-known.

Dr. Gallagher: Obviously, if the combination is abused, it can cause problems. But I do not know if any data says this is abused more than any prescription compound. The same point should be made for alternative therapies. I believe the incidence of injury by chiropractic is tiny, less than what we see, for example, with some of the triptan drugs.

Ms. Bowman: What does the literature say on alternative therapies for migraine?

Dr. Mondell: In general, the alternative or complementary treatments are not proven. Chiropractic manipulation may actually make the headache worse. Acupuncture may work for some acute migraines, but who can make an appointment and drive themselves 20 miles every time they have a headache? Still, I find it interesting how many managed care plans cover acupuncture without hard data and yet deny hospitalization or referral to a specialist.

Ms. Bowman: Keep in mind that the employer groups are very strong lobbyists in terms of the type of care that is reimbursable. That is why most insurance companies now cover acupuncture for any medical cause. The same applies to chiropractic care, herbal medicine, and even prayer medicine.

Dr. Schweitzer: Historically, this patient-demanded coverage for care that is not yet documented has been happening for years. The market for healthcare in the United States is competitive, so if patients are demanding complementary care, insurers will provide it.

Dr. Parham: I would argue that most viable insurance companies need to evaluate coverage in two dimensions: what is effective and what is demanded. Market mechanisms will determine when companies lean too far one way or the other.

... REFERENCES ...

1. Stewart WF, Lipton RB, Celentano DD, et al. Prevalence of migraine headache in the United States: Relation to age, income, race, and other sociodemographic factors. *JAMA* 1992;267:64-69.
2. Lipton RB, Stewart WF, Celentano DD, et al. Undiagnosed migraine headaches: A comparison of symptom-based and reported physician diagnosis. *Arch Intern Med* 1992;152:1273-1278.

3. 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.
4. Rasmussen BK. Epidemiology of headache. *Cephalalgia* 1995;15:45-68.
5. Henry P, Michel P, Brochet B, et al. A nationwide survey of migraine in France: Prevalence and clinical features in adults. *Cephalalgia* 1992;12:229-237.
6. Stewart WF, Linet MS, Celentano DD, et al. Age- and sex-specific incidence rates of migraine with and without visual aura. *Am J Epidemiol* 1991;134:1111-1120.
7. Lipton RB, Stewart WF. Migraine in the United States: A review of epidemiology and health care use. *Neurology* 1993;43(suppl 3):S6-S10.
8. MacGregor EA, Chia H, Vohrah RC, Wilkinson M. Migraine and menstruation: A pilot study. *Cephalalgia* 1990;10:305-310.
9. Johannes CB, Linet MS, Stewart WF, Celentano DD, Lipton RB, Szklo MD. Relationship of headache phase of the menstrual cycle among young women: A daily diary study. *Neurology* 1995;45:1076-1082.
10. Stewart WF, Lipton RB, Staffa JA, Juo H. Familial risk of migraine: A population-based study. *Annals of Neurology* 1997;41:166-172.
11. Schichtin A, Stewart WF, Pfeifer M, Silberstein S, Lipton RB. Autonomic nervous system function in migraine: A population based case-control study. *Neurology* 1999. In Press.
12. Stewart WF, Lipton RB, Liberman J. Variation in migraine prevalence by race. *Neurology* 1996;47:52-59.
13. Pryse-Phillips W, Findlay H, Tugwell P, Edmeads J. A Canadian population survey on the clinical, epidemiologic, and societal impact of migraine and tension-type headache. *Can J Neurol Sci* 1992;19:333-339.
14. Zhao F, Tsay JY, Cheng XM, et al. Epidemiology of migraine: A survey in 21 provinces of the People's Republic of China, 1985. *Headache* 1988;28:558-565.
15. Tokio S. Prevalence of migraine in western Japan. *Cephalalgia* 1993;13 (suppl 13):10.
16. Levy LM. An epidemiological study of headache in an urban population in Zimbabwe. *Headache* 1983;23:2-9.
17. Kryst S, Scherl E. A population-based survey of the social and personal impact of headache. *Headache* 1994;34:344-350.
18. Stewart WF, Lipton RB, Simon D. Work-

related disability: Results from the American migraine study. *Cephalgia* 1996;16:231-238.

19. Lipton RB, Ottman R, Ehrenberg BL, Hanser WA. Comorbidity of migraine: The connection between migraine and epilepsy. *Neurology* 1994;44(suppl 7):S28-S32.

20. Bogousslavsky J, Regli F, Van Melle G, Payot M, Uske A. Migraine stroke. *Neurology* 1988;38:223-227.

21. Breslau N, Davis GC, Schultz LR, Peterseon EL. Migraine and major depres-

sion: A longitudinal study. *Headache* 1994;34:387-393.

22. Stewart WF, Breslau N, Keck PE. Comorbidity of migraine and panic disorder. *Neurology* 1994;44(suppl 7):S23-S27.

23. Headache Classification Committee of the International Headache Society. Classification and diagnostic criteria for headache disorders, cranial neuralgias and facial pain. *Cephalgia* 1998;8(suppl 7):1-96.