Epidemiology of Pain, edited by
I.K. Crombie, IASP Press, Seattle, © 1999.

5

Gender Considerations in the Epidemiology of Chronic Pain

Linda LeResche

Department of Oral Medicine, School of Dentistry, University of Washington, Seattle, Washington, USA

BASIC CONSIDERATIONS

This chapter reviews the epidemiological literature on age- and sex-specific rates of several of the most prevalent persistent pain conditions. Although some of these data appear in other chapters in this volume, this review evaluates whether the data support the notion of universal gender differences in the prevalence of pain, or whether gender differences are confined to particular pain conditions. Where age and gender differences are observed, we hope to stimulate thinking on possible reasons for these differences.

Much discussion has occurred concerning use of the terms "sex" and "gender," with some suggesting that "sex" be used to refer to biological aspects of the person (e.g., the presence of two X chromosomes vs. one X and one Y chromosome) and "gender" to refer to the person's psychosocial identity. Others suggest the use of more complex terms such as "gender-linked" and "sex-correlated" (Deaux 1985; Gentile 1993; Unger and Crawford 1993). Epidemiology has traditionally used terms like "sex ratio" and "sex-specific rates," although data identifying the respondent's sex are usually gathered by self-report (and arguably could be called data on gender by the strict definition stated above). Because we are interested in how both biological and psychosocial aspects of maleness and femaleness can affect pain, the terms "sex" and "gender" will be used interchangeably in this chapter.

Epidemiology, as traditionally defined, is the study of the distribution, determinants, and natural history of disease in populations (Lilienfeld and Lilienfeld 1980). Although epidemiology has traditionally focused on well-defined diseases, the tools of epidemiology are being increasingly employed to study conditions such as pain and other symptomatic problems where the definition of who is a case is based on self-report, or a combination of self-report and clinical findings (Gordis 1988). While most pain researchers and clinicians are probably aware that epidemiology is useful for assessing the magnitude and burden on society of pain conditions, some may not be aware that epidemiological studies can also provide important clues concerning etiology (Morris 1975) and factors that contribute to the persistence of pain. As a case in point, the epidemiological data on patterns of chronic pain prevalence by gender suggest a number of hypotheses concerning possible reasons for gender differences that could be tested directly through basic and clinical research.

As we have discussed in a previous publication (Dworkin et al. 1992), three important perspectives are inherent in the definition of epidemiology: the population perspective, the developmental perspective, and the ecological perspective. In pain research, the population perspective implies that to understand the full spectrum of pain problems, pain conditions must be studied in entire populations, not only in persons seeking treatment. The relevance of the population perspective for understanding gender differences in pain is that for many conditions (including some pain problems) women with the condition are more likely to seek care than are men (Unruh 1996). For example, in secondary and tertiary care settings providing treatment for temporomandibular disorder (TMD) pain, the ratio of female to male patients ranges from about 5:1

to 9:1 (Bush et al. 1993), whereas in the community the ratio of prevalence in women versus men is only about 2:1 (LeResche 1997). Thus, treated patients represent a different fraction of cases in the population for each gender, and different factors may operate in women and men that influence the probability of seeking treatment. Data drawn only from clinic populations are thus likely to present an incomplete or even biased picture of gender factors related to pain.

The developmental perspective suggests that studying pain across the life cycle is essential because factors influencing a specific pain condition may vary with age. Thus, it is too simplistic to merely ask whether there are gender differences in the prevalence of a given pain condition, as the gender-specific prevalence may vary significantly with age (e.g., the probability of experiencing migraine headache may be similar for boys and girls at age 12, whereas a 30-year-old woman is much more likely than a 30-year-old man to experience this kind of pain). Data presented in this chapter will emphasize the importance of integrating the developmental perspective with a focus on gender factors in pain.

Finally, epidemiologists take an ecological approach toward the development and maintenance of a condition; disease agents, characteristics of the host, and environmental factors are all important in whether and how a condition manifests itself in a given person. This perspective is similar to the biopsychosocial perspective on pain (Engel 1960), which suggests that pain results from the dynamic interaction of biological, psychological, and social factors. Clearly, men and women not only differ in some aspects of biological and psychological processes, but also experience different socialization processes. Further, men and women are exposed to different risk factors for pain due to their differing occupational and social roles. When gender differences in pain are identified, the ecological perspective is heuristic for interpreting these differences and providing hypotheses for further study (e.g., of the range of possible associated risk factors).

This chapter will review population-based data concerning age- and gender-specific prevalence rates for a range of common chronic pain conditions. (Few studies address incidence of pain conditions.) We will discuss possible reasons for the observed differences from the developmental and ecological perspectives.

With gender-specific prevalence data, it is important to remember the fundamental relationships among prevalence, incidence, and duration in a steady-state population (prevalence = incidence × mean duration); that is, the number of cases in the population at any given time is a function not only of the rate at which new cases occur, but also how long the condition typically lasts. Most common pain conditions follow a chronic-recurrent course. For these types of conditions, the number of cases in the population at a given time (that is, prevalence) is a product of the incidence or onset rate, the number of episode recurrences, and the average episode duration (Von Korff and Parker 1980; Von Korff 1992). Thus, if we see a higher prevalence rate of a specific pain condition in one sex, that difference may be due to a higher onset rate, a higher probability of recurrence, a longer episode duration, or some combination of these components.

POSSIBLE SOURCES OF GENDER DIFFERENCES IN PAIN

What is it about being female, or about being male, that can influence the various components of prevalence? Because pain is a multidimensional experience, if we see sex differences in the prevalence or manifestations of chronic pain, differences could be occurring at several levels. Perhaps men and women have anatomical or physiological differences in the neural systems that transmit or modify pain signals (Gear et al. 1996; Berkley 1997). Men and women may differ in perceptual apparatus or perceptual styles (Fillingim and Maixner 1995), in their cognitive and emotional experiences of pain, and in their approaches to coping with pain, i.e., pain appraisal (Unruh 1996). The sexes may also vary in their pain behaviors. For epidemiological studies, the issues of willingness to report pain and how the differential socialization of males and females can influence pain report are especially important, as self-report is a primary source of data for the pain epidemiologist (LeResche 1995). Finally, the social and occupational roles of men and women differ, and those roles may present different risks for developing and maintaining pain. Societal expectations for the person in pain within the context of the family, the workplace, the welfare system, and the health care delivery system also differ by gender (e.g., Crook 1993). Most likely, differences operate simultaneously at several levels to influence the prevalence patterns of pain.

From a developmental perspective, it is clear that biological, psychological, and social factors may vary for both men and women at different points in the life cycle. Fig. 1 depicts just a few of the important biological, psychological, and social changes across the life cycle that may influence pain experience and pain behavior. Many of these life cycle changes may appear obvious, but all too frequently, gender differences are considered only in terms of biological differences, and not in a broader psychological and social context. For example, both boys and girls go through puberty, but after puberty women have monthly menstrual cycles that provide a set of physiological signals that are not experienced by men. These physiological signals (sometimes painful) could have a sensitizing effect on pain perception (Berkley 1997) or result in behavioral and social role responses (e.g., taking medication, staying in bed) that can generalize to other types of pain. To give another example, although not every woman bears children, this opportunity for pain experience is unique to women. In Western society both genders generally undergo similar phases of education followed by employment and retirement, but the specific types of educational and occupational experiences for men and women still differ to some degree. Fig. 1 could be elaborated with the addition of the social roles of parenthood, the changes in the perceptual system with age, and so on. The figure simply reinforces the point that when we think of a person of a particular age and sex, we are dealing with a whole range of biological, psychosocial, and environmental variables.

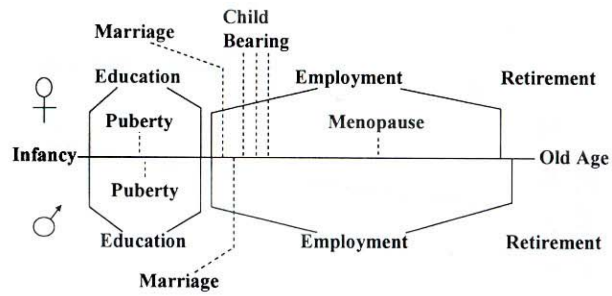

Fig. 1. Some major life cycle events that may affect the experience of pain in men and women.

DATA ON AGE- AND SEX-SPECIFIC PAIN PREVALENCE PATTERNS

This section reviews sex-specific prevalence rates for selected pain conditions across the adult age span. In keeping with the epidemiological perspectives mentioned earlier, data are presented only for studies based on random samples of defined populations, rather than particular occupational groups or clinic attendees. Unruh (1996) has provided a more comprehensive review encompassing clinical as well as population studies. A similar analysis of the prevalence of specific pain conditions by age in children could be illuminating; see Goodman and McGrath (1991) for a review of the epidemiology of pain conditions in children and adolescents. The systematic format for presenting data from various studies is an attempt to make sense of the patterns of prevalence for men and women across the life cycle. Different authors have used different case definitions and sampling approaches and studied somewhat different age groups. For these methodological reasons, the absolute prevalence rates may differ. Presenting the classification of pain conditions by prevalence pattern is an attempt to encourage consideration of similarities and differences among pain conditions and to raise awareness of possible risk factors that may vary by age and gender. The classification of these prevalence patterns represents my own scheme and was not generally the initial intent of the authors of reviewed studies.

BACK PAIN

Back pain is one of the most common pain conditions in adults. Fig. 2 shows back pain prevalence data from four population-based studies. Data for men are designated by a solid line and those for women by a dashed line. In an epidemiological study of a health maintenance organization (HMO) population in Seattle (Von Korff et al. 1988), respondents were asked to report pains occurring in the last 6 months that had lasted at least a day and were not fleeting or minor. Fig. 2a shows that back pain prevalence in this population was higher among women at younger ages and increased steadily with age in men. For persons aged 45–64, the prevalence rate for men exceeded that of women, whereas rates for both sexes were similar after age 65.

In contrast, a study of 2667 persons aged 20–60 from small towns and rural areas in Great Britain (Walsh et al. 1992, Fig. 2b) found back pain prevalence rates to be higher in young men than in young women. Rates held steady or increased only very slightly for men with age, but fluctuated with age for women in the age group studied.

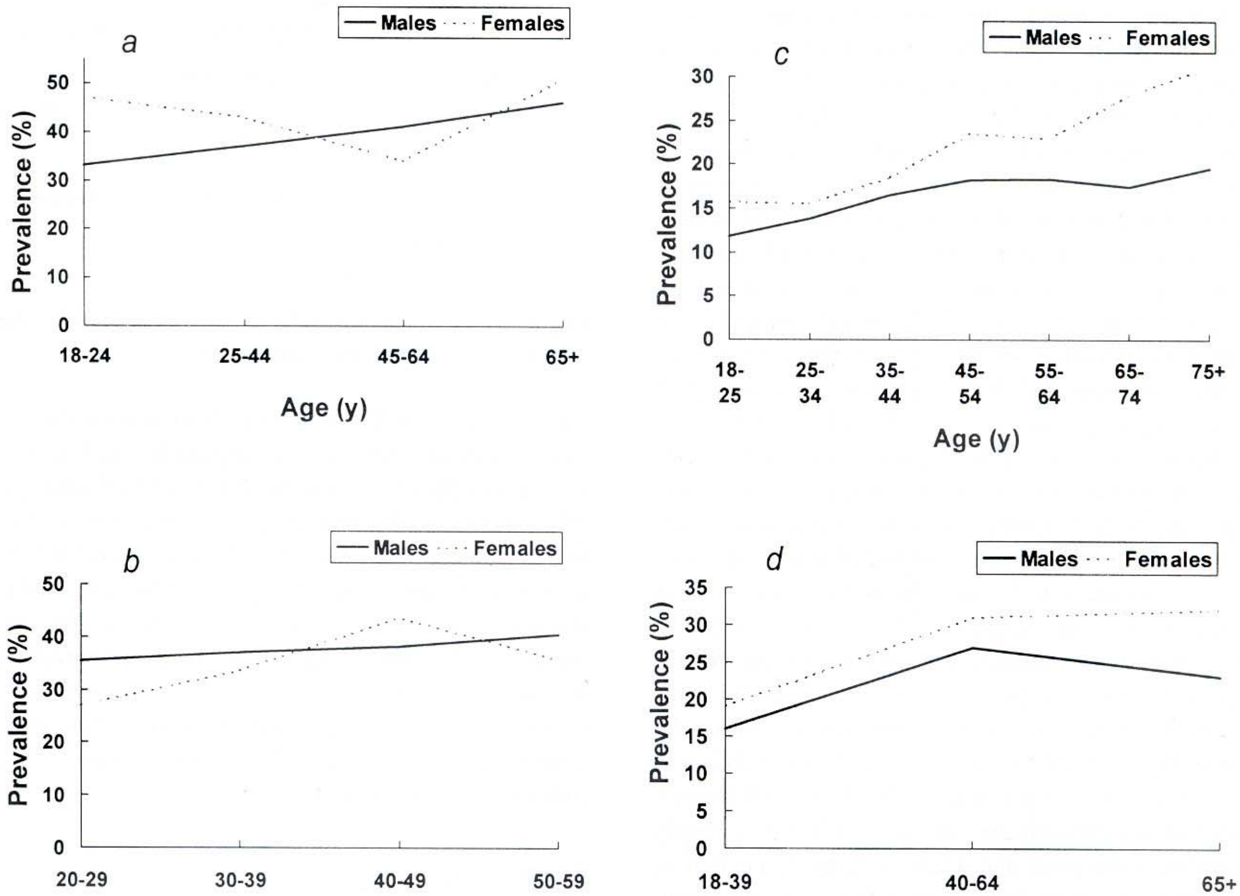

Fig. 2. Age- and sex-specific prevalence of back pain in adults. Data are from four population-based studies in North America and Great Britain. Note the different prevalence periods (1 month to 1 year) and age groupings used in the four studies. (a) Six-month prevalence of back pain in Seattle, Washington, USA (n = 1016); from Von Korff et al. (1988). (b) One-year prevalence of back pain in rural Great Britain (n = 2667); adapted from Walsh et al. (1992). (c) One-month prevalence of back pain in Great Britain (n = 9003); from Croft and Rigby (1994). (d) One-month prevalence of back pain in Great Britain (n = 34,141); from Wright et al. (1995).

Two other studies in Great Britain were consistent in finding slightly higher back pain prevalence rates in women than in men at all ages. One of these studies inquired into "problems with a bad back" in a household sample taken all over Great Britain, and found an increasing prevalence rate with age for both sexes up to age 64 (Croft and Rigby 1994, Fig. 2c). The other study (Wright et al. 1995, Fig. 2d) asked about the presence of "sciatica, lumbago, or recurring backache" in the past year. More than 34,000 persons in northwest England were surveyed. Rates rose in men from ages 18–39 to ages 40–64 and dropped slightly over age 65. For women, rates also increased from ages 18–39 to ages 40–64, but held steady thereafter.

A few epidemiological studies of back pain have focused exclusively on the elderly. Although all these studies are consistent in finding higher rates of back pain among women than among men, the reported age-specific prevalence patterns differ from study to study. For example, in a study of rural elderly in Iowa (Lavsky-Shulan et al. 1985), prevalence showed a general decline with age, whereas a study of cohorts of 70-year-olds, 75-year-olds, and 79-year-olds in Göteborg, Sweden (Bergström et al. 1986) found the highest rates for women at age 75, but the lowest rates among men aged 75. An investigation of Hong Kong residents over age 70 (Woo et al. 1994) found stable rates for women and rising rates for men with age. Thus, it is interesting that, at least on first analysis, the data for the most prevalent and one of the most

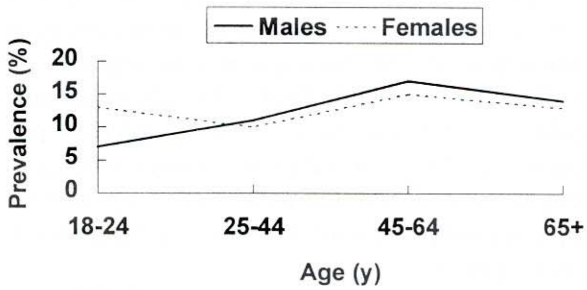

Fig. 3. Age- and sex-specific 6-month prevalence of chest pain in an HMO population in Seattle, Washington, USA (n = 1016). From Von Korff et al. (1988).

disabling pain conditions appear to be contradictory and to present no clear, consistent pattern across the studies reviewed. Urban-rural differences, socioeconomic, occupational, and cohort differences may be so powerful for back pain that the influences of age and gender on prevalence are difficult to discern (Walsh et al. 1992; Croft and Rigby 1994).

CHEST PAIN

There are few epidemiological studies of chest pain per se. Although there is some research on the prevalence of angina symptoms (Jensen 1984; Harris and Weissfeld 1991), these studies inquire into the experience of symptoms across the lifetime, rather than at a specific point in time. One investigation in an HMO population in Seattle (Von Korff et al. 1988) that inquired more broadly into the experience of chest pain in the past 6 months found that prevalence rates were higher in younger women and in older men, albeit only slightly (Fig. 3). Although this is only a single study, replication of this pattern would raise the interesting question of which factors might be operating in the lives of men and women at various ages to produce this pattern.

JOINT PAIN

Fig. 4a shows the age- and gender-specific pattern for knee joint pain from a large epidemiological study in the North of England (Lawrence et al. 1966); Fig. 4b presents data for finger joint pain from the same study. Although the patterns are not identical, both curves show a general increase in prevalence across the adult life span in both men and women; after about age 50, the curves for women and men diverge, with higher prevalence in women.

ABDOMINAL PAIN

In contrast to the conditions so far reviewed, the prevalence of abdominal pain in both sexes appears to decrease with age. The data for abdominal pain shown in Fig. 5a come from a study of large cohorts of subjects aged 30, 40, 50, and 60 in Copenhagen County, Denmark (Kay et al. 1994). Subjects were asked to report only gastrointestinal pain; menstrual pain was excluded. The percentage of women with abdominal pain was higher than the percentage of men with abdominal pain for all the ages studied, but pain prevalence decreased with age in both sexes.

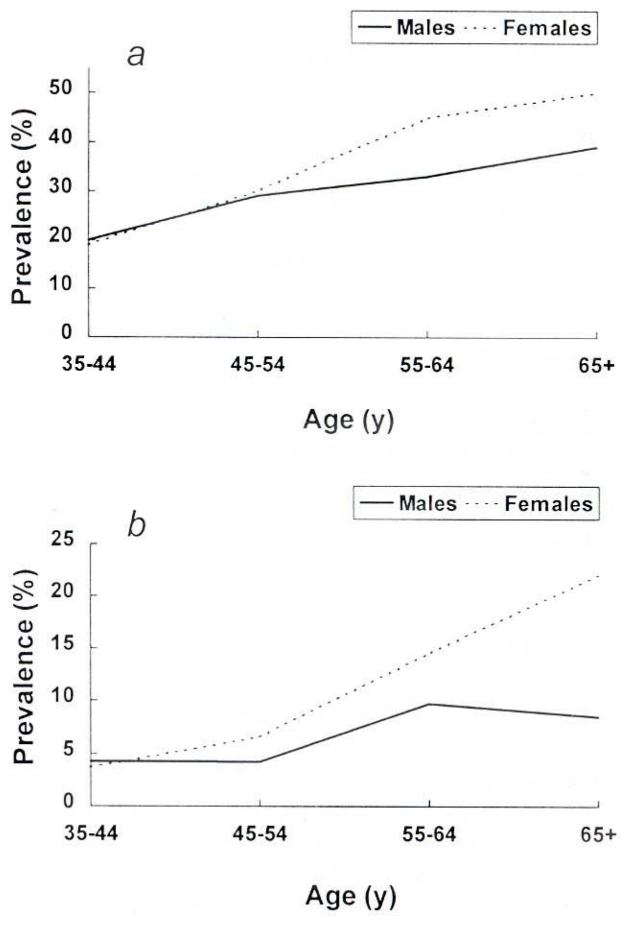

Fig. 4. Age- and sex-specific 1-week prevalence of pain, (a) in the knee joint and (b) in the finger joints in a large population-based study (n = 2292) in the North of England. From Lawrence et al. (1966).

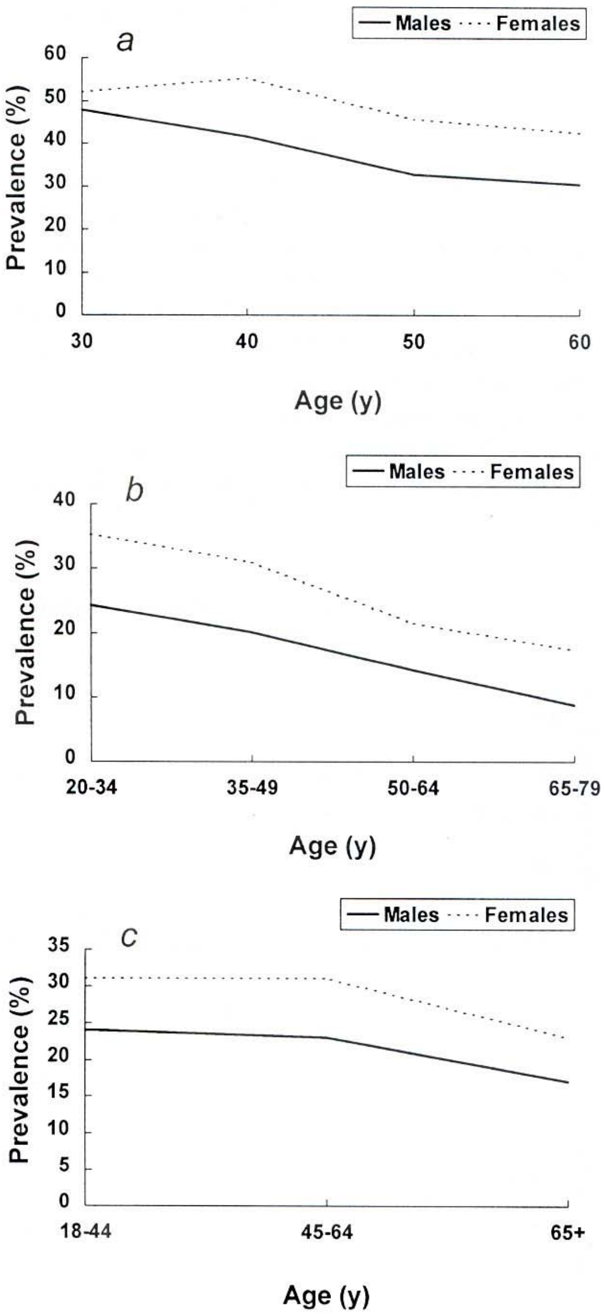

Fig. 5. Age- and sex-specific 1-year prevalence of abdominal pain in three population-based studies. Although the age groupings used are somewhat different, a similar pattern of higher rates for women and generally declining prevalence with age is found in all three studies. (a) Prevalence of abdominal pain in Copenhagen, Denmark (n = 3608); from Kay et al. (1994). (b) Prevalence of mid-abdominal pain in Östhammar, Sweden (n = 1290); from Agréus et al. (1994) . (c) Prevalence of abdominal pain in Howard City, Maryland, USA (n = 6199); from Adelman et al. (1995).

Another recent Scandinavian study conducted in rural areas and small towns in the municipality of Östhammar, Sweden, looked at pain by region of the abdomen (Agréus et al. 1994). The pattern for mid-abdominal pain (Fig. 5b) again shows a female predominance at all ages, but declining rates with age in both men and women. Prevalence rates for pain in the upper and lower abdomen, not presented here, showed similar patterns.

Finally, a study conducted in a large HMO population in Howard County, Maryland (Adelman et al. 1995, Fig. 5c) again resulted in prevalence rates showing the same pattern of higher rates in women, with declining prevalence with age. Thus, the available data on the prevalence of abdominal pain by age and sex appear highly consistent and show a higher prevalence for women than for men across the life span, with prevalence rates declining with age for both sexes.

HEADACHE AND MIGRAINE

Another common complaint that occurs at somewhat higher rates in women than in men, and appears to decline in prevalence with age, is headache. Chapter 13 presents a meta-analysis of numerous studies of the epidemiology of headache. Fig. 3 of that chapter includes an age- by sex-specific prevalence curve that suggests an almost unchanging prevalence rate across the adult life cycle for men (at about 60% of the population), and a curve for women that is relatively flat (with prevalence about 75–80%) until about age 45, when rates decline. By about age 60, prevalence rates for men and women appear similar. This curve summarizes studies using different definitions of headache; particularly for males, case definition explained much of the variability in prevalence rates. It is possible that prevalence curves based on studies that use different case definitions for specific types of non-migraine headaches (e.g., for tension-type headache) could show a somewhat different pattern (e.g., Rasmussen et al. 1991).

In contrast to the pattern for other types of headache, numerous epidemiological studies of migraine in a variety of cultures have replicated the finding of a clear bell-shaped curve for age-specific prevalence in both sexes, with rates rising over the reproductive years and declining after age 40 (see Stewart et al. 1994 for a review). As shown in Fig. 1 of Chapter 13, rates for women are substantially higher than for men at all adult ages.

TEMPOROMANDIBULAR DISORDER PAIN

Another set of pain conditions that follows the same age- by sex-specific prevalence pattern as migraine is pain in the muscles of mastication or the temporomandibular joint—TMD pain. Data from the Seattle study (Von Korff et al. 1988) shown in Fig. 6 indicate a peak in the 25–44 age range and a steep decline with age, again with higher prevalence in women across the entire adult life span. Other recent prevalence studies, including one in Toronto (Locker and Slade 1988) and one in Québec (Goulet et al. 1995), show a similar pattern.

CHRONIC WIDESPREAD PAIN AND FIBROMYALGIA

Chronic widespread pain is defined by the standardized criteria of the American College of Rheumatology (ACR) (Wolfe et al. 1990) as pain of longer than 3 months' duration in two contralateral quadrants of the body. Using these criteria Croft et al. (1993) surveyed a sample of persons enrolled in two general practices in Cheshire, England, in an area that included both a suburb of Manchester and a rural town. Prevalence data, based on the 1340 survey respondents, are shown in Fig. 7a. For men, rates of chronic widespread pain rose until about age 65, dropped in those 65–74 years of age, and then rose again in the very elderly. For women, the shape of the curve was similar, although the first prevalence peak appeared at a younger age for women than for men. For all the ages surveyed, except ages 55–64, prevalence rates were substantially higher for women than for men.

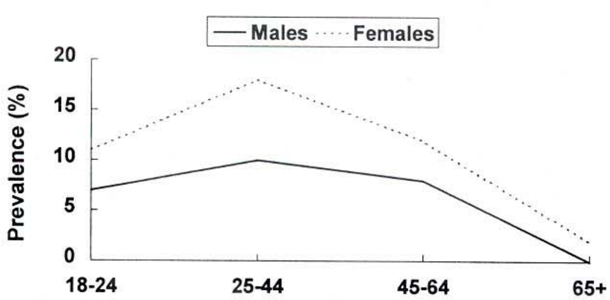

Fig. 6. Age- and sex-specific 6-month prevalence of temporomandibular pain in an HMO population in Seattle, Washington, USA (n = 1016). Rates for women peak in the 25–44-year-old age group. From Von Korff et al. (1988).

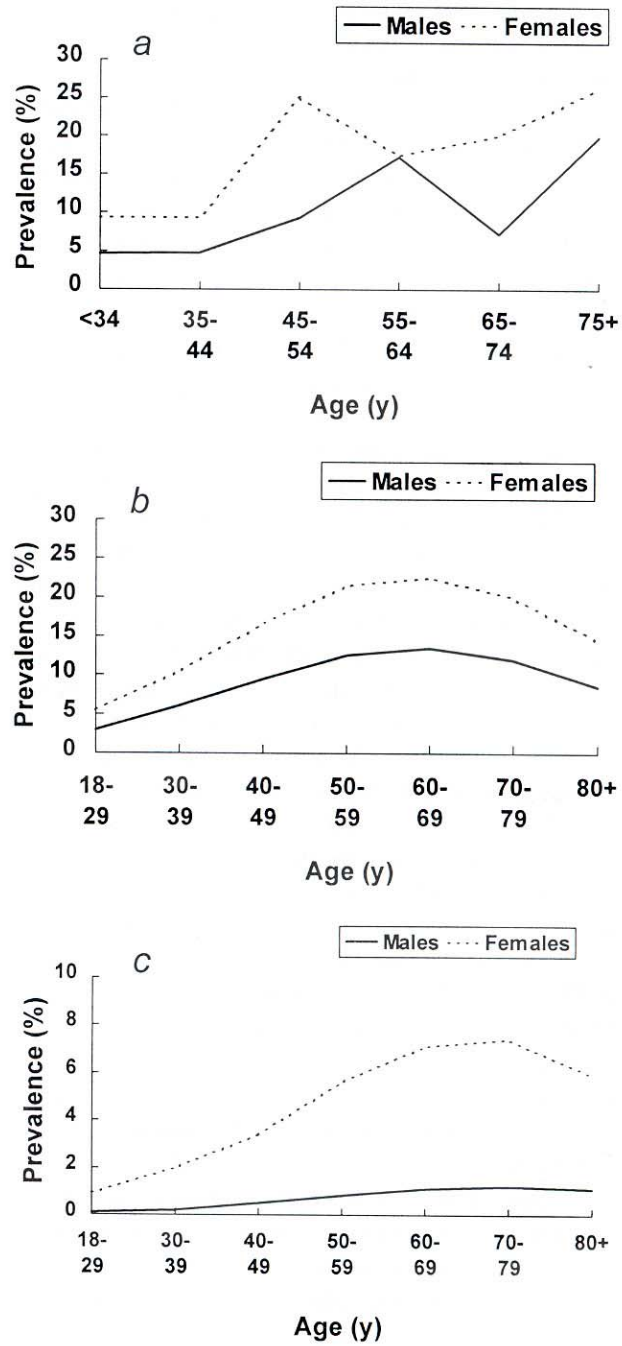

Fig. 7. Age- and sex-specific rates of chronic widespread pain and fibromyalgia from population studies in Britain and the United States. (a) Point prevalence of chronic widespread pain in Cheshire, United Kingdom (n = 1340); from Croft et al. (1993). (b) Point prevalence of chronic widespread pain in Wichita, Kansas, USA (logistic model, crude weighted rates, n = 3006); adapted from Wolfe et al. (1995). (c) Three-month prevalence of fibromyalgia in Wichita, Kansas (n = 3006); adapted from Wolfe et al. (1995).

Fig. 7b shows data from a community survey of 3006 persons from randomly selected households in Wichita, Kansas (Wolfe et al. 1995); this survey used the same case definition for chronic widespread pain as did the work by Croft et al. (1993). Unlike the data presented in the other figures in this chapter, which are strictly sample-based, the data in Fig. 7b represent weighted rates, based on the age-gender distribution of the Wichita population. The crude weighted rates were then smoothed using a logistic model. Fig. 7b shows prevalence rates that were consistently higher for women than for men, and rose across the adult life span through age 69, but dropped off in the very elderly. Thus, considering the difference in analytic methods, the age and gender patterns of chronic widespread pain for the two studies shown in Figs. 7a and 7b display some similarities. Rates in young adulthood are on the order of 5% in men and 10% in women. In middle age, the rates begin to rise fairly steeply, especially for women. However, the pattern found for the elderly differs in the two studies, with the British study showing rising rates after age 74 and the U.S. study showing falling rates. Nevertheless, both studies are consistent in finding higher rates in women than in men. Because neither study had a large sample in the very oldest age group, the discrepancy could be due to the unreliability of the estimates for persons over age 75.

In addition to studying chronic widespread pain, Wolfe et al. (1995) followed up a sample of respondents to assess how many met ACR examination criteria for fibromyalgia (i.e., the presence of pain on palpation in at least 11 of 18 designated body sites, and chronic widespread pain, as illustrated in Fig. 2 of Chapter 9). The resulting age- and sex-specific prevalence curve, weighted and smoothed, as in Fig. 7b, shows a pattern similar to Wolfe's prevalence data for chronic widespread pain, although the absolute rates are lower and the gender difference is more dramatic for fibromyalgia (Fig. 7c).

SUMMARY AND DISCUSSION

The data presented in this chapter suggest that there is not a simple relationship between gender and the occurrence of pain. Patterns differ from condition to condition, and gender- specific prevalence for most conditions varies across the life cycle. Although for most body sites women are more likely than men to report pain, this is not the case for every condition at every stage of life. For back pain, the available data are not consistent with regard to the prevalence by gender and age. Definitive information on chest pain is also lacking, not due to inconsistent results but to the paucity of epidemiological studies of chest pain per se.

For other pain conditions, however, the age- and sex-specific prevalence patterns are more clear. Joint pain, chronic widespread pain, and fibromyalgia all appear to *increase* in prevalence with age in both genders at least up to around age 65, and all show higher prevalence in women than in men. Abdominal pain also consistently shows higher prevalence in women than in men but *decreases* in prevalence with age. The prevalence of nonmigrainous headache also appears to decrease somewhat with age, at least in women. Finally, migraine headache and TMD are substantially more common in women than in men and appear to follow a bell-shaped curve, which peaks in the reproductive years.

Although there are clearly prevalence differences related to age, most of the common pain conditions reviewed here show a general pattern of at least somewhat higher prevalence in women than in men. These generally higher rates may be due to a higher biological sensitivity to stimuli; women may detect signals that men might not notice. At a cognitive level, the threshold for labeling stimuli as painful might be lower for women than for men. Another factor may be a social difference in the upbringing of boys and girls, which makes it more acceptable for women to report the experience of pain. There is some empirical support for all these hypothesized factors (Unruh 1996; Berkley 1997), and it is quite likely that biological, psychological, and social factors are all operating to some degree to produce the observed prevalence differences.

The pattern of increasing pain prevalence with age, such as that shown for joint pain, chronic widespread pain, and fibromyalgia, suggests either progressive, degenerative conditions (which are known to be relevant in at least some instances), or possibly the accumulation of cases in the population with age. Studies of pain incidence, in addition to pain prevalence, would be necessary to untangle the relative importance of these factors. Given that at least some data suggest a possible decline of these conditions among the very elderly (Bergström et al. 1986; Wolfe et al. 1995), it appears important to investigate whether persons with these conditions recover over time or are at increased risk for disability or even mortality, which removes them from community populations as they age.

In contrast, abdominal pain and headache (at least in women) show a consistent pattern of declining prevalence with age. It is intriguing to consider what biological or psychological changes associated with aging might be *protective* against the occurrence or continuation of these conditions. Likely candidates for investigation might be life stress or work-related factors. It is also possible that some abdominal pain is referred pain of gynecological origin (Giamberardino et al. 1997), which might be expected to diminish with age.

The pattern of prevalence for migraine and TMD pain suggests a possible relationship to factors that are present in young adulthood into middle age but are less common in the elderly. Hormonal factors have for some time been postulated as possible risk factors for migraine (e.g., Somerville 1972; Stewart et al. 1991), and recent evidence suggests the possible role of hormonal factors in TMD (LeResche et al. 1997; Dao et al. 1998). Interestingly, both the excellent incidence data available for migraine (Chapter 13) and the more limited data available for TMD suggest that both these conditions are rather uncommon in children and that incidence rates rise sharply beginning at puberty, further strengthening the possibility of a pain-hormone relationship. Of course, it is possible—even likely—that psychological as well as biological factors associated with life cycle changes also influence the onset and maintenance of these pain conditions (LeResche 1997). In any case, the unusual prevalence pattern of these pain problems raises a number of hypotheses regarding possible risk factors that could be further investigated not only with epidemiological methods, but also through basic and clinical research.

In conclusion, a review of the epidemiological literature indicates definite age by sex differences in the prevalence of many chronic pain conditions. Little information is available to shed light on whether these prevalence differences are due to different incidence rates, different probabilities of recurrence, or different durations of pain (or some combination of these factors) for women and men. However, a systematic examination of the epidemiological data may be an important step in helping pain researchers of all kinds to generate hypotheses in our search for a better understanding of chronic pain in both sexes.

ACKNOWLEDGMENTS

During the preparation of this chapter the author was supported in part by NIH Grant No. DE08773. Portions of this work have been previously presented at the NIH Office of Research on Women's Health Seminar Series (March 1998) and the NIH Conference on Gender and Pain (April 1998).

REFERENCES

Adelman AM, Revicki DA, Magaziner J, Hebel R. Abdominal pain in an HMO. *Fam Med* 1995; 27:321–325.

Agréus L, Svardsudd K, Nyren O, Tibblin G. The epidemiology of abdominal symptoms: prevalence and demographic characteristics in a Swedish adult population. *Scand J Gastroenterol* 1994; 29:102–109.

Bergström G, Bjelle A, Sundh V, Svanborg A. Joint disorders at ages 70, 75 and 79 years—a cross-sectional comparison. *Br J Rheumatol* 1986; 25:333–341.

Berkley KJ. Sex differences in pain. *Behav Brain Sciences* 1997; 20:371–380.

Bush FM, Harkins SW, Harrington WG, Price DD. Analysis of gender effects on pain perception and symptom presentation in temporomandibular pain. *Pain* 1993; 53:73–80.

Croft PR, Rigby AS. Socioeconomic influences on back problems in the community in Britain. *J Epidemiol Community Health* 1994; 48:166–170.

Croft PR, Rigby AS, Boswell R, Schollum J, Silman A. The prevalence of chronic widespread pain in the general population. *J Rheumatol* 1993; 20:710–713.

Crook J. Comparative experiences of men and women who have sustained a work related musculoskeletal injury. *Abstracts: 7th World Congress on Pain*. Seattle: IASP Publications, 1993, pp 293–294.

Dao TTT, Knight K, Ton-That V. Modulation of myofascial pain by reproductive hormones: a preliminary report. *J Prosthet Dent* 1998; 79:663–670.

Deaux K. Sex and gender. *Annu Rev Psychol* 1985; 36:49–81.

Dworkin SF, Von Korff M, LeResche L. Epidemiologic studies of chronic pain: a dynamic-ecologic perspective. *Ann Behav Med* 1992; 14:3–11.

Engel G. A unified concept of health and disease. *Perspect Biol Med* 1960; 3:459–485.

Fillingim RB, Maixner W. Gender differences in the responses to noxious stimuli. *Pain Forum* 1995; 4:209–221.

Gear RW, Miaskowski C, Gordon NC, et al. Kappa-opioids produce significantly greater analgesia in women than in men. *Nature Medicine* 1996; 2:1248–1250.

Gentile DA. Just what are sex and gender anyway? A call for a new terminological standard. *Psychological Science* 1993; 2:120–122.

Giamberardino MA Berkley KJ, Iezzi S, de Bigontina P, Vecchiet L. Pain threshold variations in somatic wall tissues as a function of menstrual cycle, segmental site and tissue depth in non-dysmenorrheic women, dysmenorrheic women and men. *Pain* 1997; 71:187–197.

Goodman JE, McGrath PJ. The epidemiology of pain in children and adolescents: a review. *Pain* 1991; 46:247–264.

Gordis L. Challenges to epidemiology in the next decade. *Am J Epidemiol* 1988; 128:1–9.

Goulet J-P, Lavigne GJ, Lund JP. Jaw pain prevalence among French-speaking Canadians in Quebec and related symptoms of temporomandibular disorders. *J Dent Res* 1995; 74:1738–1744.

Harris RB, Weissfeld LA. Gender differences in the reliability of reporting symptoms of angina pectoris. *J Clin Epidemiol* 1991; 44:1071–1078.

Jensen G. Epidemiology of chest pain and angina pectoris: with special reference to treatment needs. *Acta Med Scand* 1984; (Suppl) 682:1–120.

Kay L, Jorgensen T, Jensen KH. Epidemiology of abdominal symptoms in a random population: prevalence, incidence, and natural history. *Eur J Epidemiol* 1994; 10:559–566.

Lavsky-Shulan M, Wallace RB, Kohout FJ, et al. Prevalence and functional correlates of low back pain in the elderly. *J Am Geriatr Soc* 1985; 33:23–28.

Lawrence JS, Bremner JM, Bier F. Osteo-arthrosis: prevalence in the population and relationship between symptom and x-ray changes. *Ann Rheum Dis* 1966; 25:1–23.

LeResche L. Gender differences in pain: epidemiologic perspectives. *Pain Forum* 1995; 4:228–230.

LeResche L. Epidemiology of temporomandibular disorders: Implications for the investigation of etiologic factors. *Crit Rev Oral Biol Med* 1997; 8:291–305.

LeResche L, Saunders K, Von Korff M, Barlow W, Dworkin SF. Use of exogenous hormones and risk of temporomandibular disorder pain. *Pain* 1997; 69:153–160.

Lilienfeld AM, Lilienfeld DE. *Foundations of Epidemiology,* 2nd ed. New York: Oxford University Press, 1980.

Locker D, Slade G. Prevalence of symptoms associated with temporomandibular disorders in a Canadian population. *Community Dent Oral Epidemiol* 1988; 16:310–313.

Morris JN. *Uses of Epidemiology,* 3rd ed. Edinburgh: Churchill Livingstone, 1975.

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.

Somerville BW. The influence of progesterone and estradiol upon migraine. *Headache* 1972; 12:93–102.

Stewart WF, Linet MS, Celentano DD, Van Natta M, Ziegler D. Age- and sex-specific incidence rates of migraine with and without visual aura. *Am J Epidemiol* 1991; 134:1111–1120.

Stewart WF, Shechter A, Rasmussen BK. Migraine prevalence: A review of population-based studies. *Neurology* 1994; 44(Suppl 4):S17–S23.

Unger RK, Crawford M. Sex and gender: the troubled relationship between terms and concepts. *Psychological Science* 1993; 2:122–124.

Unruh AM. Gender variations in clinical pain experience. *Pain* 1996; 65:123–167.

Von Korff M. Epidemiologic and survey methods: chronic pain assessment. In: Turk DC, Melzack R (Eds). *Handbook of Pain Assessment.* New York: Guilford Press, 1992, pp 391–408.

Von Korff M, Parker RD. The dynamics of the prevalence of chronic episodic disease. *J Chron Dis* 1980; 33:79–85.

Von Korff M, Dworkin SF, LeResche L, Kruger A. An epidemiologic comparison of pain complaints. *Pain* 1988; 32:173–183.

Walsh K, Cruddas M, Coggon D. Low back pain in eight areas of Britain. *J Epidemiol Community Health* 1992; 46:227–230.

Wolfe F, Smythe HA, Yunus MB, et al. The American College of Rheumatology 1990 criteria for the classification of fibromyalgia. *Arthritis Rheum* 1990; 33:160–172.

Wolfe F, Ross K, Anderson J, Russell IJ, Herbert L. The prevalence and characteristics of fibromyalgia in the general population. *Arthritis Rheum* 1995; 38:19–28.

Woo J, Ho SC, Lau J, Leung PC. Musculoskeletal complaints and associated consequences in elderly Chinese aged 70 years and over. *J Rheumatol* 1994; 21:1927–1931.

Wright D, Barrow S, Fisher AD, Horsley SD, Jayson MIV. Influence of physical, psychological and behavioural factors on consultations for back pain. *Br J Rheumatol* 1995; 34:156–161.

Correspondence to: Linda LeResche, ScD, Department of Oral Medicine, School of Dentistry, University of Washington, Seattle, WA 98195, USA. Fax: 206-685-8412; email: leresche@u.washington.edu.