CHAPTER 2

EPIDEMIOLOGY

Mary Amanda Dew
University of Pittsburgh School of Medicine
Evelyn J. Bromet
State University of New York at Stony Brook

INTRODUCTION

No mass disorder afflicting mankind has ever been eliminated or brought under control by attempts at treating the affected individual, nor by training large numbers of individual practitioners.

—JOHN E. GORDON

Gordon's words, arising from decades of his own work on factors associated with health and illness (Gordon, 1958; Plunkett & Gordon, 1960), provide the reason that basic research is fundamental to preventive medicine and public health. And the basic science of both of these disciplines is epidemiology. Epidemiology is the study of patterns of illness in the population and of the factors that affect these patterns (Lilienfeld & Lilienfeld, 1980). With respect to psychopathology in particular, a subspecialty of epidemiology — psychiatric epidemiology — focuses on mental disorders and symptoms in the population and on the risk factors that influence their origin and course.

Mental disorders occur in every sociocultural group in the world. In the United States, an estimated 12% of children (Institute of Medicine, 1989) and 15% of adults (Regier et al., 1988a), currently suffer from one or more disorders. Yet only a minority of mentally ill individuals, 30% to 40% (Weissman, Myers, & Thompson, 1981; Vernon & Roberts, 1982), are identified by the health care system. It is this minority on whom traditional research techniques of clinical observation and laboratory experimentation are typically based. Although this research has improved our understanding of factors associated with psychopathology, the relative role of such factors in the larger ill but untreated population remains less clear. By focusing on psychopathology under natural conditions in whole populations, the psychiatric epidemiologist thus provides an empirical base that complements and extends data gathered through traditional clinical and laboratory techniques.

Psychiatric epidemiology, as practiced today, is a relatively young discipline. Nevertheless, in the

past few decades considerable strides have been made in understanding the epidemiology of, for example, suicide, depression, schizophrenia, substance abuse, and disorders of childhood and old age. Although the etiology of most conditions remains unknown, the risk factors identified in this recent research suggest avenues for control and prevention of psychopathology, as well as potential directions for etiologic study. Psychiatric epidemiologists have focused primarily on personal and environmental risk factors, although new research on genetic epidemiology is beginning to make central contributions to our understanding of many disorders. The core of this chapter focuses on current knowledge about personal and environmental risk factors for three of the most common and/or widely studied mental disorders: depression, substance abuse, and schizophrenia. Where relevant, recent findings from genetic epidemiology are incorporated as well. Although we devote the most attention to recent diagnostic studies, important earlier results from classic studies are also described.

BASIC PREMISES

Psychiatric epidemiologic research is conducted at three levels: descriptive, analytic, and experimental. Table 2.1 summarizes key terms and study designs relevant to each of these research levels.

Descriptive epidemiology aims at ascertaining the occurrence of disorder by time, place, and person. The *prevalence* rate (the ratio of all existing cases during a given time period to the defined population) and the *incidence* rate (the ratio of newly diagnosed cases during a given time period to the population at risk for developing a first episode of an illness) are two basic tools of descriptive epidemiology. Determination of these rates depends on three factors:

1. An accurate count of the number of *cases* of illness or disorder in the study population (i.e., the numerator of the rate) is required. As discussed later in this chapter, the issue of case definition has been one of special significance for psychiatric epidemiology.
2. The *population at risk* (i.e., the denominator) must be specified; it denotes the group of individuals from whom the cases were identified.
3. These rates must be calculated for a specified *time frame* – for example, incidence during a 12-month period; prevalence at one point in time (point prevalence); or prevalence during a given period of time (period prevalence).

TABLE 2.1. Key concepts in epidemiologic research

LEVEL OF RESEARCH	BASIC TERMS	COMMON STUDY DESIGNS
I. Descriptive epidemiology	Prevalence rate Incidence rate Case Population at risk Cohort	Prevalence study Incidence study
II. Analytic epidemiology	Risk factor	Retrospective study Prospective study Follow-back study
III. Experimental epidemiology	Random assignment	Natural experiment

Descriptive epidemiologic studies are often referred to as *prevalence studies* when they utilize cross-sectional survey designs in which a group of individuals – a *cohort* – are interviewed at one point in time and prevalence rates for current and past periods of time are estimated. In *incidence studies,* a cohort is followed forward for a given period of time and new cases are identified. An important recent descriptive epidemiologic study that incorporated both of these study designs is the Epidemiologic Catchment Area (ECA) research program. In this study, close to 20,000 individuals from catchment areas in New Haven, CT; St. Louis, MO; Baltimore, MD; Los Angeles, CA; and Durham, NC, were interviewed with a structured diagnostic instrument, the Diagnostic Interview Schedule (DIS; Robins, Helzer, Croughans, & Ratcliff, 1977). The DIS obtains information on a specific set of mental disorders and is scored according to the criteria specified in the third edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III; American Psychiatric Association, 1980). Six-month and

lifetime prevalence rates were determined from the interview. Then, in order to estimate incidence rates, a follow-up interview using the DIS was conducted with respondents one year after their original assessment. Later in this chapter, basic findings on prevalence and incidence rates are presented.

The second level of epidemiologic research is *analytic* epidemiology, which examines why a rate is high or low in a given population. Studies under this rubric test hypotheses about whether specific variables serve as *risk factors* for particular disorders. Risk factors are characteristics whose presence increases the risk of developing a disorder. True risk factors exist prior to the onset of a disorder. This preexistence is easy to establish for some variables, such as gender and ethnicity. However, the insidious nature of the onset of many psychiatric disorders often makes it difficult to determine whether many variables, such as social class and marital status, are risks or consequences of disorder. Thus, to date, although analytic epidemiologic studies have yielded a great deal of data on the size and nature of associations between risk factors and disorder, they have less convincingly demonstrated that these associations have a causal component.

Three types of study designs are often employed at the level of analytic epidemiology. First, *retrospective studies* typically compare psychiatric cases to controls who do not have the disorder under investigation. These groups are examined for the presence of hypothesized antecedent risk factors for the disorder. For example, several such studies have found that loss of a parent during childhood is more common among depressed adults than among nondepressed controls (Pfohl, Stangl, & Tsuang, 1983; Roy, 1981).

A second type of study design is the *prospective* design, which identifies one of two types of cohorts and follows them over time. Prospective studies aimed at identifying risk factors predicting the *onset* of a disease identify and follow an initially *healthy* cohort. An example of such a study is Vaillant's (1983) 40-year effort to follow a group of initially healthy Harvard undergraduates in order to examine their subsequent health and social functioning. Prospective studies of factors associated with the *course* of illness identify representative cohorts of *cases* at the start of their illness and follow them naturalistically over time. Thus, several recent studies have followed first-episode schizophrenic patients for periods as long as five years in order to examine various parameters of outcome (Biehl, Maurer, Schubart, Krumm, & Jung, 1986; Shepherd, Watt, Falloon, & Smeeton, 1989).

A third study design is the *follow-back* design, also referred to as anterospective or as a mixed prospective-retrospective approach. With this strategy, a cohort is selected on the basis of archival data (e.g., agency records) collected many years previously. The rate of disorder during the interval from the time the early records were created until the present is then examined and compared to the rate in a selected control group. Robins (1966) conducted a particularly noteworthy study utilizing this design. She reviewed 30-year-old child guidance clinic records in order to identify a cohort at risk for future psychiatric impairment. She then retrieved data on the following 30-year interval in order to trace individuals' subsequent natural history of childhood disorder and the development of antisocial behavior relative to a control group.

The third level of epidemiologic research is *experimental* epidemiology, which attempts to establish a causal relationship between a variable of interest and a specific psychiatric outcome. This may involve *randomly assigning* individuals to treatment or control groups in the case of a clinical trial of a drug, or to exposure and nonexposure groups in the case of an environmental agent such as a chemical exposure in the workplace. In many field settings, however, random assignment (in which all participants begin with an equal probability of receiving an exposure) is rarely possible, and the more common design is the *natural experiment*. In this situation, the investigator has (often fortuitously) collected data from a population, only some of whom go on to receive exposure to an environmental agent. The previously collected data thus become baseline data, and the population can be followed forward through time to examine differences between exposed and nonexposed groups. If the groups were similar in every

respect (except for the subsequent exposure) at baseline, then follow-up differences are likely to be attributable to the exposure. We were presented with such a situation in an ongoing longitudinal study of a cohort of mothers of young children residing in western Pennsylvania (Dew, Bromet, & Schulberg, 1987a; Penkower, Bromet, & Dew, 1988). During the course of the field work we learned that some of these women's husbands had lost their jobs during a period of massive recession in the steel industry. Other women were not exposed to job loss in their immediate family during this period. We utilized data collected prior to the onset of layoffs as baseline data, and followed both exposed and nonexposed groups forward in time to chart the long-term mental health effects of husband's job loss.

In sum, the methodologies utilized at the three levels of epidemiologic research were developed to provide data relevant to prevention and control of illness. Two additional requirements for research at any of the three levels are *representative sampling* and a *reliable and valid case definition.* The importance of these requirements and the ways they have been met within psychiatric epidemiology are best understood within a historical context. A historical perspective also helps to define psychiatric epidemiology's current contribution to the understanding of adult psychopathology.

ROLE IN PSYCHOPATHOLOGY

A Brief History

The growth of psychiatric epidemiologic research has been divided into three periods, or generations (Dohrenwend & Dohrenwend, 1982), each characterized by its view on the sampling and case definition issues. First-generation studies, conducted prior to World War II, relied on key informants' reports and agency records for case ascertainment. The first prevalence study of this sort was conducted in Massachusetts in 1854 by Edward Jarvis, who undertook a census on the "insane" by gathering information from general practitioners, other key informants such as clergymen, and records of mental hospitals and other official agencies (Jarvis, 1971). He identified 2,632 "lunatics" and 1,087 "idiots" needing "the care and protection of their friends or of the public for their support, restoration or custody" (p. 17).

A classic first-generation study was conducted by Faris and Dunham (1939), who compared rates of mental illness across geographic areas. They reviewed medical records from four state hospitals serving the Chicago area between 1922 and 1934 in order to identify cases; they then determined the rate per 100,000 of adult population for different sections of Chicago. They found that rates of mental illness, and of schizophrenia in particular, decreased progressively as one moved away from the city center. Thus, 46% of the cases of schizophrenia were from the inner-city area, compared to 13% from the outermost districts. Faris and Dunham argued that the inner-city environment was conducive to mental illness, and their findings have been replicated many times (see Giggs, 1986, for a review). Other interpretations of these data are discussed in a subsequent section of this chapter.

As in most first-generation studies, Faris and Dunham relied on medical records rather than a community survey approach in order to identify cases. However, U.S. Army experiences during World War II, in which large numbers of presumably healthy recruits failed to pass a psychological symptom screen, suggested that treated cases represent the tip of the iceberg. (Extensive subsequent work has confirmed that not only do treated cases represent a minority of psychiatrically ill individuals, but a number of factors are systematically associated with treatment seeking. For example, individuals seeking outpatient professional help have been found more likely to be female, younger, better educated, divorced, urban dwellers, Jewish, frequent church/temple attenders, residing in Pacific states, and having divorced parents and fathers with professional occupations (Veroff, Kulka, & Douvan, 1981).)

The Army findings during World War II prompted a series of community studies – second-generation studies – on the extent of psychiatric impairment in the general population. These

studies were designed using random sampling techniques and symptom-based interview schedules derived from the Neuropsychiatric Screening Adjunct, the psychological screening tool developed by the Army during World War II. These studies focused on psychiatric "impairment" rather than on specific diagnostic categories, which at the time could not be reliably operationalized. The belief that treated cases represented a minority of all cases proved to be true. Indeed, community sample impairment rates in studies such as the Midtown Manhatten Project (Srole, Langner, Michael, Kirkpatrick, Opler, & Rennie, 1962) and the Nova Scotia study (Leighton, Harding, Macklin, Macmillan, & Leighton, 1963) were considerably higher than those found in first-generation pre-World War II research. Thus, whereas the median current prevalence rate of disorder was estimated to be 3.6% in the first-generation studies (Dohrenwend & Dohrenwend, 1982), the median rate from second-generation studies was 20%.

Psychometric advances in the area of diagnosis in the 1970s paved the way for today's third generation of psychiatric epidemiologic studies, many of which are characterized by their use of structured diagnostic interview schedules embodying the most recent psychiatric nomenclature (although studies of symptom impairment are still being conducted as well). Psychometric work was initially stimulated by Kramer's (1961) earlier observation that first-admission rates for schizophrenia were higher in the United States, whereas those for depression were higher in England. He questioned whether these differences reflected true differences in morbidity or artifacts of diagnosis. This simple observation led to the first major scientific study of the determinants of diagnosis, which demonstrated that the application of systematic interviewing techniques and comparable diagnostic criteria resulted in similar diagnostic distributions (Cooper, Kendell, Gurland, Sharpe, & Copeland, 1972). Several years later, the International Pilot Study of Schizophrenia demonstrated that patients could be reliably diagnosed in countries worldwide, including the United States, with structured diagnostic interview schedules (World Health Organization, 1975; Sartorius et al., 1986).

In the United States, the need to define homogeneous patient populations for clinical drug trials and multicenter collaborative research prompted further developments in structured interviewing techniques and reliable diagnostic criteria. Rejecting the use of general clinical descriptions to make diagnoses, Feighner, Robins, and Guze (1972) published the first set of specific research criteria that listed the symptoms and their duration required for each diagnosis. Six years later, the now widely used Research Diagnostic Criteria (RDC) (Spitzer, Endicott, & Robins, 1978) – which represent revisions of the Feighner criteria – and an accompanying semistructured interview schedule, the Schedule for Affective Disorders and Schizophrenia (SADS) (Endicott & Spitzer, 1978), were published. Weissman and Myers (1980) first applied the SADS to a community population, showing that diagnoses could be made in the field. With the publication of DSM-III (1980) and DSM-III-R (1987), Spitzer, Williams, Gibbon, and First (1987) developed the Structured Clinical Interview for DSM-III-R (SCID). The SCID builds upon its predecessor, the SADS, and both require clinically experienced raters.

Utilizing highly experienced clinicians can be costly; in epidemiologic studies of large community samples, training lay interviewers to conduct the field work is more cost-effective than hiring experienced mental health professionals. Thus, in the late 1970s, the National Institute of Mental Health (NIMH) decided to sponsor the development of a fully structured interview that could be administered by lay interviewers. Their ultimate goal was to estimate the rates of discrete psychiatric disorders in unbiased, community populations. The new instrument was the Diagnostic Interview Schedule (DIS), a fully structured DSM-III based schedule (Robins et al., 1977). The DIS has been administered in several community surveys, including the ECA study. A similarly devised instrument for children aged 6 through 18 is under development (Costello, Costello, Edelbrock, Burns, Dulcan, & Brent, 1988).

Like any tool that relies solely on respondents'

memories and understanding of the questions being posed, the instruments we have discussed are far from being perfectly valid or reliable diagnostic techniques. These difficulties were illustrated by a study of women's reports of lifetime depression, which found that over an 18-month period women often failed to recall earlier lifetime episodes that they had previously described at the first interview, or provided new information about lifetime episodes that they had not mentioned originally (Bromet, Dunn, Connell, Dew, & Schulberg, 1986). On the other hand, the significance of the shift from impairment ratings to diagnostic categories in epidemiologic studies cannot be underestimated. This shift has helped to bridge the gap between psychiatric epidemiology and clinical psychiatry and psychology by providing clinical outcomes – diagnoses – that are understood across disciplines.

CURRENT KNOWLEDGE ABOUT PREVALENCE, INCIDENCE, AND RISK FACTORS FOR MENTAL DISORDERS

The ECA study, described earlier, has been the most comprehensive prevalence and incidence study using modern assessment techniques. The 6-month and lifetime prevalence rates and the 12-month incidence rates of disorders assessed across all five study sites are reported in Table 2.2 (Eaton et al., 1989; Myers et al., 1984; Regier et al., 1988a; Robins et al., 1984). The most prevalent DIS/DSM-III disorders were substance abuse, major depression, and phobia; together they account for well over half of the total 6-month and lifetime prevalence rates of all disorders. The least common disorders were schizophrenia and schizophreniform disorder, mania, and somatization. Regier et al. (1988a) compared ECA prevalence data to those obtained in five international prevalence studies and found that ECA rates for affective (mania, major depression, dysthymia) and anxiety disorders (phobia, panic, and obsessive-compulsive disorders) were within the range of rates reported in the international studies. The ECA rate for all DIS disorders combined (including impairment, and antisocial personality disorders, which were not assessed internationally) was also within the range of international rates.

One of the most important contributions of psychiatric epidemiology to the understanding of psychopathology has been the identification of risk factors for mental disorders. We review data regarding the two major classes of such factors: personal and environmental variables. We focus, as noted earlier, primarily on three of the most common and/or widely studied mental disorders: depression, substance abuse, and schizophrenia.

Personal Risk Factors

As shown in the upper section of Table 2.3, risk factors in this class may be characterized either as fixed, unmodifiable features of an individual or as factors more amenable to change. This distinction is important because intervention efforts to prevent or ameliorate mental disorder will be quite different in the presence of each of the two types of risk factors. For example, prevention efforts in the case of unmodifiable factors may aim to alter other features of the individual's environment so as to minimize the impact of these factors. In contrast, prevention efforts for modifiable factors may focus on changing the factors themselves (see Hough, 1982, for further discussion of prevention implications).

Gender. Although men and women have been found to have very similar overall rates of mental disorder in the United States (Regier et al., 1988a), there appear to be marked gender differences in prevalence rates of specific disorders, including depression, substance abuse, anxiety, and personality disorders. Such differences have appeared in general population studies, in studies conducted in primary medical care settings, and in studies of psychiatric patients. In the ECA study, the male:female ratios were approximately 1:2 for depression, 6:1 for alcohol abuse/dependence, 2:1 for drug abuse/dependence, 1:2 to 1:3 for phobias, and 4:1 for antisocial personality disorder (Regier et al., 1988a; Robins et al., 1984). Both social and biological factors are likely to contribute to these differences. Gender differences in

TABLE 2.2. Prevalence and incidence rates of DIS/DSM-III disorders among persons 18 years and older across five Epidemiologic Catchment Area study sites (New Haven, CT; Baltimore, MD; St. Louis, MO; Durham, NC; Los Angeles, CA)

DIS DISORDER[a]	RATE (PERCENT) AND (SE)		
	LIFETIME PREVALENCE	6-MONTH PREVALENCE	12-MONTH INCIDENCE
Any DIS disorder	32.2 (0.5)	19.1 (0.4)	—[b]
Alcohol abuse/dependence	13.3 (0.4)	4.7 (0.2)	1.8 (0.2)
Drug abuse/dependence	5.9 (0.2)	2.0 (0.1)	1.1 (0.2)
Major depressive episode	5.8 (0.3)	3.0 (0.2)	1.6 (0.2)
Dysthymia	3.3 (0.2)	—	—
Manic episode	0.8 (0.1)	0.5 (0.1)	—
Phobia	12.5 (0.3)	7.7 (0.3)	4.0 (0.3)
Obsessive-compulsive	2.5 (0.2)	1.5 (0.1)	0.7 (0.1)
Panic	1.6 (0.1)	0.8 (0.1)	0.6 (0.1)
Antisocial personality	2.5 (0.2)	0.8 (0.1)	—
Schizophrenia	1.3 (0.1)	0.8 (0.1)	—
Schizophreniform disorder	0.1 (0.0)	0.1 (0.0)	—
Cognitive impairment[c]	—	1.3 (0.1)	1.2 (0.1)
Somatization	0.1 (0.0)	0.1 (0.0)	—

N = 18,571

Note: Prevalence rates are adapted from Regier et al. (1988a). Incidence rates are adapted from Eaton et al. (1989), and do not include the New Haven site.

[a]DIS indicates Diagnostic Interview Schedule.

[b]Rate was not examined.

[c]Only current impairment at time of interview was assessed.

social roles and role performance, drinking habits, ways of expressing emotional problems, the likelihood of seeking treatment, as well as professional biases in diagnosis, may largely account for them (Briscoe, 1982).

Although the prevalence of schizophrenia does not appear to differ by gender, the risk period occurs at an earlier age in men than in women. Men tend to present for treatment in their late teens and early twenties, whereas women are more likely to have their first treatment contact in their late twenties and early thirties (Eaton, Day, & Kramer, 1988).

Age. ECA prevalence data indicate that overall rates for all psychiatric disorders, as well as specific rates for depression and anxiety disorders, were higher in those aged 18 to 44 than in older individuals (Regier et al., 1988a; Robins et al., 1984). The rates of both alcohol and drug abuse/dependence were highest among individuals aged 18 to 24, consistent with findings from national surveys of drinking patterns, which suggest that the peak period for heavy drinking and associated serious problems, such as driving or fighting while intoxicated, occurs in the early twenties (Cahalan & Cisin, 1980). The manifestations of schizophrenia also appear to vary with age, with prevalence rates generally dropping, particularly among women, after age 45 (Regier et al., 1988a).

Ethnicity. In the United States, prevalence data reveal few striking ethnic differences once the effects of social class have been taken into account. For example, lifetime prevalence rates for most of the disorders assessed in the ECA study were similar among American black and nonblack respondents (Robins et al., 1984). One exception to this pattern concerns major depression, for which white men tend to have higher prevalence rates than black men, but black women have higher prevalence rates than white women (Sommervell, Leaf, Weissman, Blazer, & Bruce, 1989).

As for black–white comparisons, comparisons of Mexican-Americans and nonHispanic whites in the Los Angeles ECA revealed relatively similar

TABLE 2.3. Widely studied personal and environmental risk factors for the onset of mental disorder

PERSONAL FACTORS	
UNMODIFIABLE	MODIFIABLE
Gender	Social class
Age	Marital status
Ethnicity	Physical illness
Personal history of mental disorder	
ENVIRONMENTAL FACTORS	
MACROENVIRONMENTAL	MICROENVIRONMENTAL
Community-wide stressors	Individual stressful life events
	Multiple life events and chronic strains
	Physical conditions of the environment

rates of most disorders (Burnam et al., 1987; Karno et al., 1987). The two exceptions were drug abuse/dependence and major depression, for which Mexican-Americans had lower rates than non-Hispanic whites.

Ethnic differences in schizophrenia have been studied for many years. Early prevalence studies of treated samples within the United States suggested that, compared to whites, blacks were disproportionately diagnosed with schizophrenia and were hospitalized at a younger age and for longer periods of time (Fried, 1975). Given the ECA study findings of no differences in blacks' and whites' rates of schizophrenia in the community, it is possible that ethnic differences in earlier studies primarily reflected treatment differences between social groups.

International data suggest that schizophrenia is concentrated in certain other ethnic groups: higher than expected rates have been found among native-born Israelis (Eaton, 1983), in parts of Croatia (Crocetti, Lemkau, Kulcar, & Kesic, 1971) and in western Ireland (Walsh, O'Hare, Blake, Holpenny, & O'Brien, 1980). These high rates cannot be explained by differential emigration or unusual environmental circumstances.

It is noteworthy that ethnic differences in suicide rates have been consistently reported throughout the 20th century, with whites of all ages having higher rates than both blacks and some other ethnic groups, including Japanese-Americans (Kramer, Pollack, Redick, & Locke, 1972). However, age-adjusted suicide rates for Native Americans and Chinese-Americans are higher than those for whites (Kramer et al., 1972). Indeed, the rate among youth in some Native American tribes is over twice that for the U.S. population of the same age, an alarming statistic (May, 1987).

Personal history of mental disorder. In addition to the well-known fact that a positive history of a disorder increases one's risk for new episodes of the disorder (e.g., Amenson & Lewinsohn, 1981), an important finding in psychiatric epidemiology is that individuals with one disorder often also meet criteria for a second, different disorder. Although both disorders may begin simultaneously, it has often been observed in treated populations that new disorders arise among individuals previously diagnosed with another disorder. Thus, patients with alcohol abuse/dependence often develop a secondary depression during the course of the alcoholism. Schizophrenic patients discharged after their first lifetime admission often develop depression during the subsequent year. Recent epidemiologic findings have confirmed the relatively common co-occurrence of multiple psychiatric disorders in the general population, such as alcohol abuse/dependence with drug abuse/dependence (measure of association, Odds Ratio [OR] = 10.7), alcohol abuse/dependence with antisocial personality (OR = 15.5), obsessive-compulsive disorder with panic disorder (OR = 20.6), and major depression with somatization (OR = 26.8) (Boyd et al., 1984).

Familial history of mental disorder. Considerable research on familial aggregation of psychopathology is underway and seeks to identify both sociocultural and biological familial risk factors. Although family, twin, and adoption studies have established that genetic factors are involved in the etiology of a variety of disorders, the precise degree of heritability and mode of genetic transmission remains to be specified (Merikangas, 1987). With respect to depression, a review of family studies indicated that there is a

two- to threefold increase in the disorder in first-degree adult relatives of depressed patients (Weissman, 1987a). A study of the offspring of depressed patients also found a threefold increase in risk of psychiatric disorder among these children (Weissman, Prusoff, Gammon, Merikangas, Leckman, & Kidd, 1984). The preponderance of evidence regarding alcohol abuse/dependence also points to a genetic vulnerability to this disorder (Merikangas, 1990). The risk of developing this disorder in the presence of an affected parent is 25% for men and 5% for women (Goodwin, 1984; Merikangas, 1987).

In schizophrenia, monozygotic twins have a concordance rate for the disorder between 33% and 78%, compared to 8% to 28% for dizygotic twins. The risk of developing schizophrenia in the presence of an affected first-degree relative is approximately 10% (compared to an overall prevalence of less than 1%) (Kendler, 1988). Although promising early results from genetic linkage studies of schizophrenia and bipolar disorder were not confirmed in subsequent replications, the next two decades are expected to yield important advances in this area.

Social class. In his prevalence study described earlier, Jarvis noted in 1855 that "the pauper class furnishes, in ratio of its numbers, sixty-four times as many cases of insanity as the independent class" (Jarvis, 1971, pp. 52–53). Since then, the relationship between social class and mental illness has been one of the most extensively documented associations within the epidemiology of mental disorders. Lower social class status has been consistently found to be associated with depressive symptoms, substance abuse/dependence, antisocial personality disorder, and especially schizophrenia (Dohrenwend & Dohrenwend, 1974; Faris & Dunham, 1939; Schwab & Schwab, 1978). However, it has rarely been possible to draw strong inferences about the causal direction of this relationship. Some, notably Faris and Dunham (1939), have argued for a "social causation" explanation – that the stressful conditions of being in the lowest class foster illness onset. However, the alternative, "social selection" explanation – that vulnerable people drift downward into the lowest class – is often equally plausible.

One of the most influential studies supporting a social causation interpretation was conducted by Hollingshead and Redlich (1958), who demonstrated that among psychiatric patients, higher rates of schizophrenia occurred in lower social classes. Most of these patients had lived in poor areas of the city all of their lives. Moreover, 90% of their families of origin were in the same social class, suggesting that downward social mobility could not explain the findings. More recent studies of individuals' social class backgrounds, however, have indicated that social selection is the more compelling explanation, at least for schizophrenia (Turner & Gartrell, 1978). For example, schizophrenic patients' occupational attainment is typically lower than that of their fathers and lower than that predicted from their school careers (e.g., Goldberg & Morrison, 1963).

Marital status. Both marital status and quality of the relationship have been associated with psychiatric disorder. In the ECA study, for example, both men and women were two to three times more likely to have had a recent psychiatric disorder if they were unmarried rather than married (Leaf, Weissman, Myers, Tischler, & Holzer, 1984). Even more striking was the finding that, among married individuals, the rate of disorder was four times higher among those who did not get along very well with their spouses compared to more happily married persons.

These relationships have been observed not only for total rates of any disorder, but for specific diagnoses such as major depression (Leaf, Weissman, Myers, Holzer, & Tischler, 1986). The causal direction of these associations remains unclear due to the cross-sectional nature of most studies. At least for depression, however, a growing body of longitudinal evidence suggests that causality flows in both directions: Marriage affects one's mental health, which, in turn, influences the future of the marriage (Brown & Harris, 1978; Dew & Bromet, 1991; Krantz & Moos, 1987).

With respect to schizophrenia, being unmarried elevates the risk of the disorder (Eaton, 1983); and, among schizophrenics, being single at the

time of first hospital admission is associated with a poorer prognosis (e.g., Bland, Parker, & Orn, 1978). It is difficult, however, to determine the effects of marital status independent of known gender differences in schizophrenia: It is usually male patients who are likely to be unmarried, because, as noted earlier, males tend to be hospitalized in their late teens and early twenties, before many individuals get married.

Physical illness. Both medical outpatient and inpatient populations have been found to have rates of psychiatric disorder substantially elevated over rates for the general population (Houpt, Orleans, George, & Brodie, 1980; Rodin & Voshart, 1986). Studies of primary medical care populations indicate that, overall, 5% to 20% of patients present with "significant mental disorder" (Houpt et al., 1980). Prevalence rates for specific types of disorder among such patients have been estimated at, for example, 2% to 23% for psychoses (Houpt et al., 1980) and 11% to 26% for depression (Rodin & Voshart, 1986). In the ECA study in particular, 22% of respondents who had recently utilized a medical care facility met criteria for a DSM-III disorder, compared to 17% of nonutilizers (Kessler et al., 1987). Affective disorders were the most common diagnoses in women, and alcohol abuse/dependence was most common in men.

Among medically ill inpatients, depression – the psychiatric disorder most frequently studied – has been found to occur in up to 25% of this population (Rodin & Voshart, 1986). The rate of depression appears to increase with the severity of the physical illness. Thus, Moffic and Paykel (1975) found that 61% of severely medically ill inpatients were depressed compared to 21% of less ill patients.

Physical illness appears to act as a significant risk factor for mental disorder through both psychosocial and biological pathways. Psychosocially, an illness may elevate risk of mental disorder by affecting body image, self-esteem, and capacity to function at work and socially. Biologically, there is evidence that patients' risk for depression, for example, is elevated by certain endocrine disorders, nutritional or electrolyte abnormalities, some viral disorders, and drug effects (Hall, 1980; Klerman, 1981; Rodin & Voshart, 1986).

As for the other risk factors we have discussed, it is also likely that the comorbidity of physical and psychiatric disorder is explained in some cases by the psychiatric disorder leading to physical health changes. Depression in medical patients is sometimes predictive of a shortened life expectancy (Wai, Burton, Richmond, & Lindsay, 1981). Indeed, the mortality rate among psychiatrically ill individuals in general is higher than that expected for the general population (Babigian & Odoroff, 1969; Munoz, Marten, Gentry, & Robins, 1971; Bruce & Leaf, 1989).

Environmental Risk Factors

Stressful events and circumstances have been demonstrated to elevate significantly an individual's risk of psychiatric disorder as well as subclinical psychiatric symptoms. As shown in the lower section of Table 2.3, these environmental stressors may be macroenvironmental events (e.g., natural and technological disasters) that affect large segments of the population and are relatively cataclysmic disruptors of social life (Hough, 1982). Alternatively, they may be microenvironmental factors that, though potentially devastating, affect relatively small portions of a given population.

Community-wide stressors. These stressors expose large numbers of people to uncontrollable events. Both acute and long-term mental health effects have been studied for such events, including volcanic eruptions (Shore, Tatum, & Vollmer, 1986), floods (Titchener & Kapp, 1976), tornadoes (Moore, 1958), and fires (Green, Grace, & Gleser, 1985). Our research group conducted a longitudinal study of the psychiatric sequelae of a technological disaster, the 1979 Three Mile Island (TMI) nuclear accident. Unlike natural disasters, TMI was not an acute, time-limited event but entailed a sequence of interrelated stressful occurrences that unfolded over a long period of time, including the initial crisis, intermittent radiation leaks, and difficulties surrounding the cleanup operations. It also differed from

other disasters in that no lives were lost nor property damaged. In a longitudinal study of mothers of preschool children living within 10 miles of the plant, the rate of major depression and generalized anxiety was twice that of an unexposed comparison group during the year after the accident (Bromet, Parkinson, Dunn, Schulberg, & Gondek, 1982). Women who experienced these relatively acute psychiatric effects went on to experience elevated psychiatric symptom levels during the following 5 years (Dew, Bromet, Schulberg, Dunn, & Parkinson, 1987b).

There appears to be no single pattern of psychiatric consequences to community-wide stressors, most likely because they vary in intensity and duration. Recent reviews have emphasized that an additional element of such events that also appears to be responsible for inducing psychiatric distress is their degree of involvement in terms of loss of life or property (Bromet & Schulberg, 1987; Solomon, 1989).

Individual stressful life events. Single traumatic events, though perhaps as personally devastating as community-wide stressors, typically occur at a more individual level in the population. Thus, life events such as job loss (Penkower et al., 1988), bereavement (Jacobs, Hansen, Berkman, Kasl, & Ostfeld, 1989), physical injury (Dew, Lynch, Ernst, Rosenthal, & Judd, 1985), and sexual assault (Scheppele & Bart, 1983) have been noted to produce changes in mental health. Most studies show initial increases in psychiatric disturbance and somatic complaints. Although some studies have found relatively few effects extending beyond an initial acute period, others have found these effects to persist for months and sometimes years. Indeed, recent reviews have concluded that a large minority of individuals — 20% to 40% — do not recover fully from major life stressors despite the passage of many years (Kessler, Price, & Wortman, 1985). Extended stress effects have been primarily noted in the areas of somatic complaints and affective disorder and associated symptoms.

Some of the earliest observations of deleterious mental health effects following stressful life events occurred during the two world wars, when many previously mentally healthy soldiers suffered from "shell shock," or combat stress reactions, when faced with extreme combat stress or deprivation. Since the Vietnam War, there has been considerable interest in establishing the prevalence of post-traumatic stress disorder (PTSD) among not only combat veterans but individuals experiencing a wide range of traumatic events. PTSD is defined as a response to an unusual stressor in which an individual reexperiences the traumatic event through recurrent thoughts or dreams; experiences psychic numbing; and has symptoms such as sleep disturbance, survivor guilt, difficulty concentrating, hyperalertness, avoidance of activities associated with the event, and/or an intensification of symptoms if exposed to a similar event. A recent national study of Vietnam veterans reported a point prevalence rate of 15.2% and a lifetime rate of 31% (Kulka et al., 1988).

Life events and chronic strains. The most extensive body of literature on environmental stress focuses on the mental health effects of multiple stressors, conceptualized as either acute life events or chronic strains. In contrast to studies of the aftermath of single traumatic events, the multiple life events literature focuses not so much on the nature of specific events as on whether the occurrence of *any* stressful event, as well as the total *number* of events that an individual experiences, is associated with certain mental health outcomes. In general, the occurrence of stressful life events is prognostic for depressive disorders and symptomatology (Kessler et al., 1985). However, the size of these effects is small, at best accounting for about 9% of the variance in the onset of depression in community samples (e.g., Rabkin & Struening, 1976).

Adverse life events may play a stronger causal role in the occurrence of depression in particular individuals already made vulnerable by other factors. For example, Brown and Harris (1978) have shown that threatening life events precipitate episodes of depression in middle- to lower-class women who already lack a confiding relationship with their husbands, are unemployed, have three or more children under the age of 6 in the home, and have lost a parent in childhood. Several large

literatures have developed around the issues of whether or not factors such as poor social support and poor coping strategies elevate one's vulnerability to psychiatric distress in the face of stressful life events (for reviews, see Cohen & Wills, 1985; Kessler et al., 1985).

The effects of stressful life events may also be somewhat larger in patient populations than in community samples. For example, among individuals with schizophrenia, the occurrence of stressful life events may trigger psychotic episodes, particularly in patients with inadequate social network supports (Brown & Birley, 1968; Zubin, Steinhauer, Day, & Van Kammen, 1985).

Some stressful occurrences are more appropriately characterized as chronic, ongoing strains, rather than discrete events. There is evidence that such strain arising from one's social roles, from the marriage, from occupational demands, etc. elevates psychological distress – and depressed mood in particular – in community samples (e.g., Pearlin, Lieberman, Menaghan, & Mullen, 1981; Pearlin & Schooler, 1978). Additional studies of occupational samples have noted that employees in jobs characterized by high levels of demand, little autonomy over decision making, conflicting requirements, and ambiguity experience higher levels of psychological symptoms and alcohol abuse than do employees experiencing less occupational stress (Kasl, 1978). The combination of high demands and low decision latitude has been shown to be particularly stressful (Karasek, 1979; Bromet, Dew, Parkinson, & Schulberg, 1988).

In sum, there is strong evidence that chronic strains are associated with mental health. However causal interpretation of this association remains problematic: most chronic strain measures are based on subjective assessments and thus may sometimes be symptoms of, rather than risk factors for, respondents' psychiatric impairment.

Physical conditions of the environment. Two aspects of the physical environment that have received extensive study in relation to mental health are occupational exposure to chemicals, and the location and nature of one's living arrangements.

An extensive clinical literature has demonstrated that intense exposure to lead, mercury, carbon monoxide, carbon disulphide and the like can cause serious central nervous system (CNS) disturbances (Feldman, Ricks, & Baker, 1980). In *Alice in Wonderland,* Lewis Carroll immortalized the well-known hallucinations, delusions, and mania produced by high-level mercury exposure in the character of the Mad Hatter. Since the 19th century, dramatic case reports have described cognitive and neurasthenic symptoms, and even suicide, in workers exposed to a variety of solvents. As late as the 1940s, a significantly elevated suicide rate was reported in workers exposed to carbon disulfide (Mancuso & Locke, 1972).

An issue of current concern is potential neuropsychiatric effects of low-level chemical exposure. Two such exposures that have been investigated extensively are inorganic lead and solvents. In addition to the documented developmental effects of low-level lead exposure in children (Needleman et al., 1979), studies of low-level lead exposure among workers have noted effects on neuropsychological functioning (e.g., Hogstedt, Hane, Agrell, & Bodin, 1983), and on measures of personality and anxiety (e.g., Haenninen, Hernberg, Mantere, Vesanto, & Jalkanen, 1978). Unfortunately, these findings were based on volunteer samples, poorly matched controls, and nonblind raters. In recent epidemiologic research, no significant effects of low-level lead exposure on either neuropsychological or psychiatric status were reported (Parkinson, Ryan, Bromet, & Connell, 1986).

The findings for low-level solvent exposure are more complex. Several large-scale epidemiologic studies of male workers chronically exposed at threshold or subthreshold levels have reported significantly more CNS symptoms (headaches, fatigue, depression, dizziness, memory disturbances), nonspecific somatic complaints (nausea, abdominal pain, skin problems), and/or impaired performance on cognitive tasks compared to unexposed controls (e.g., Axelson, Hane, & Hogstedt, 1976). These studies, however, have been criticized for containing serious methodological flaws (Errebo-Knudsen & Olsen, 1986). There remains no definitive answer as to the effects of low-level solvent exposure, particularly in women, who have

only rarely been studied. Two recent cross-sectional studies of female workers found that low-level solvent exposure was significantly associated with increased depressive symptoms, CNS disturbance, and an array of nonspecific somatic complaints (Dew, Bromet, Parkinson, Dunn, & Ryan, 1989; Parkinson, Bromet, Cohen, Dunn, Dew, & Ryan, 1990). However, these studies had to rely primarily on self-reported exposures, and their conclusions need to be verified in other samples.

Turning to the mental health effects of physical characteristics of the nonwork environment, three domains of study are noteworthy. First, whether an individual resides in an urban or a rural area has been consistently related to rates of mental illness. In a comprehensive review of community prevalence studies, Dohrenwend and Dohrenwend (1974) showed that total rates of mental illness were higher in urban than in rural areas, although whether this resulted from the stresses of living in an urban environment or from the migration of ill individuals to an urban environment remains unresolved. The elevated urban rates appeared due to an excess of "neurosis" (which encompasses many of the current DSM-III-R affective disorders) and personality disorder in urban areas. In fact, total rates for psychoses tended to be higher in rural settings, although schizophrenia in particular appeared equally frequent in rural and urban settings. Subsequent studies have confirmed the pattern noted above, especially for neurotic disorders such as depression (e.g., Mueller, 1981; Blazer et al., 1985).

A second aspect of one's nonwork physical environment that has been studied extensively, particularly in England after World War II, is housing characteristics. For example, studies of effects of high-rise housing have shown an association between living on higher floor levels and heightened psychological strain (Gillis, 1977). Apartment dwellers have been found to be more depressed and lonely than demographically similar individuals residing in single-family houses (Richman, 1974). A large literature on density and crowding suggests that measures of "social pathology" (e.g., juvenile delinquency rates, admissions to mental hospitals, and public assistance rates) may be associated with environmental factors such as the number of residents per room and the number of rooms per housing unit (e.g., Galle, Gove, & McPherson, 1972).

A third important aspect of one's residential environment concerns the effects of *lack* of a permanent residence, and the associated rising pandemic of homelessness. Rates of mental illness among homeless adults are alarmingly high (see Bassuk, 1986, for a detailed review). For example, Koegel, Burnam, and Farr (1988) reported that more than one-quarter of homeless individuals in a Los Angeles sample had a major chronic mental illness such as schizophrenia or substance abuse. In some cities, deinstitutionalization of the mentally ill from state facilities has significantly contributed to the problem of homelessness. The risk of homelessness among discharged state hospital patients was as high as 28% in a New York setting (Susser, Lin, Conover, & Struening, 1990).

FUTURE DIRECTIONS

An ultimate goal of epidemiology is to identify causes of disease so as to provide information useful in disease prevention. For a given disorder, epidemiologic work begins with the assessment of the distribution of the disorder in the population, followed by delineation of risk factors associated with that distribution, leading to experimental efforts to intervene on one or more such factors in order to prevent or control the disorder. Notions of representative sampling and a reliable and valid case definition are fundamental to this process, and psychiatric epidemiology has advanced through three stages in attempting to incorporate these notions: First-generation studies defined cases on the basis of treatment seeking; second-generation studies relied on global impairment scales to assess community populations; and third-generation studies employ methods of diagnostic categorization to examine cases in the population. All three approaches continue to be used today.

Much of psychiatric epidemiology has focused on the identification of personal characteristics and/or social environmental risk factors for psychiatric disorder. Which of these risk factors

are causally linked to disorder is unknown, although the etiologies of most mental disorders are believed to be multifactorial. One task for future research is to build and test causal models which further integrate the variety of individually identified risk factors. Evaluation of these models will require: (a) more frequent use of longitudinal study designs capable of disentangling predictors of disorder from the disorder and its consequences, and (b) the wider application of experimental and quasi-experimental methods to examine how much of the link between a risk factor and a disorder is due to a causal component (Kessler et al., 1985). Application of experimental methods is difficult but not impossible to employ in psychiatric epidemiologic research, as evidenced by, for example, studies taking advantage of "natural experiments."

Even in the absence of knowledge about the etiology of a given disorder, experimental intervention efforts aimed at changing a known risk factor may effectively lead to a reduction in rate of disorder in a population (Earls, 1987). Indeed, one of the central challenges for the field of psychiatric epidemiology is to accelerate the development and – particularly – the evaluation of prevention efforts for the major psychiatric disorders. As will be summarized briefly, some prevention efforts, developed on the basis of psychiatric epidemiologic data, have already been undertaken at primary, secondary, and tertiary prevention levels.

Primary prevention refers to efforts to reduce the incidence of a disorder and has been successfully applied in the few situations where the etiology of a psychiatric disorder was understood and the environmental cause could be eliminated. Thus, psychoses resulting from pellagra and brain damage from measles and rubella have essentially been eradicated in the United States through primary prevention efforts. In the workplace, applications of standards such as the U.S. Occupational Safety and Health Administration's Lead Standard have reduced many chemical exposures to levels at which neuropathy, encephalopathy, or other mental disorders rarely occur.

What needs greater recognition is the fact that primary prevention efforts can begin even when etiology is unknown. Such efforts can target asymptomatic individuals in groups already shown by epidemiologic research to be at high risk for a disorder. For example, several such programs have been aimed at reducing psychological difficulties in recently separated couples; substance abuse and delinquency in young adolescents with a history of poor academic performance and disruptive behaviors; and depression in low-income mothers and in adults undergoing major life changes (Price & Smith, 1984). Only a few such programs have received systematic evaluation of their effectiveness. Examples include some school-based teenage suicide prevention programs, the goals of which are to heighten awareness of the problem and to provide information about mental health resources (e.g., Shaffer, Garland, Gould, Fisher, & Trautman, 1988).

The focus of third-generation psychiatric epidemiologic studies on case finding in the general population provides the necessary framework for the expansion of secondary prevention efforts, which refer to the treatment of populations who are in the early stages of a disorder in order to prevent episode recurrence or resulting disability. Currently, the workplace has become a focal point for secondary intervention programs. Although their effectiveness has not been determined, many companies have established Employee Assistance Programs to counsel troubled employees. The goal of these programs is to detect mental health problems at an early stage and offer an intervention that might help to avert a full-blown psychiatric episode.

Finally, tertiary prevention is designed to minimize long-term disability and handicap in patients with a history of mental illness. An important example, developed on the basis of both clinical and epidemiologic work, is the NIMH Depression/Awareness, Recognition, and Treatment program (Regier, Hirschfeld, Goodwin, Burke, Lazar, & Judd, 1988b). The program is a mixed secondary and tertiary prevention effort aimed at educating mental health professionals, nonpsychiatric general medical practitioners, and the lay public about the symptoms and treatments for affective disorder.

In addition to the continued application of

epidemiologic data to the development of prevention programs, the future of psychiatric epidemiology is likely to involve closer ties with clinical research and practice (Feinstein, 1985; Weissman, 1987b). Epidemiology and clinical research already share many study designs and analytic strategies. As suggested previously, however, epidemiology could be enriched by continuing beyond the enumeration of risk factors, to incorporating and testing clinically developed models of *how* risk factors come to affect psychopathology. Clinical research, on the other hand, could benefit from more extensive consideration of traditionally epidemiologic concerns with representative sampling and standardized diagnostic assessment. For example, representative sampling issues are relevant not only to the selection of general community samples, but also to the selection of individuals from *patient* populations.

With respect to the connection of epidemiology with clinical practice, closer ties may help to reduce the number of epidemiologic studies which, though well designed, continue to focus on a narrow range of often unmodifiable risk factors (e.g., gender, age, social class) and yield findings of limited relevance to actually improving the health of sick people (Weissman, 1987b). Alternatively, clinical understanding of psychopathology may be enriched by incorporating the epidemiologic fact that data about mental disorder obtained from patients often does not represent the full spectrum of the disorder and its prognosis (Weissman, 1987b; Cohen & Cohen, 1984).

In sum, though a relatively young discipline, psychiatric epidemiology has developed and applied important case-finding techniques in community samples and, once cases are identified, has described an array of risk factors that are associated with psychopathology. Although the etiology of most disorders remains unknown, epidemiologic data provide valuable clues to appropriate interventions to avert and/or minimize the effects of mental disorders. Increased integration of psychiatric epidemiology with clinical research and practice will afford new opportunities to test clinically derived models of the development and progression of mental disorders in community populations. This epidemiologic work will lead, in turn, to an enriched clinical understanding of psychopathology.

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Library of Congress Cataloging-in-Publication Data

Psychopathology in adulthood / edited by Alan S. Bellack, Michel Hersen.
p. cm.
Includes bibliographical references and indexes.
ISBN 0-205-14584-1
1. Psychology, Pathological. I. Bellack, Alan S. II. Hersen, Michel.
[DNLM: 1. Psychopathology. 2. Mental Disorders. WM 100 P97488 1993]
RC454.P787 1993
616.89--dc20
DNLM/DLC
for Library of Congress 93-16114
CIP

ISBN 0-205-14584-1
H45842

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1 97 96 95 94 93