Journal of Abnormal Psychology
1998, Vol. 107, No. 2, 305-311

0021-843X/98/$3.00

Comorbid Mental Disorders: Implications for Treatment and Sample Selection

Denise L. Newman
University of Wisconsin—Madison

Terrie E. Moffitt and Avshalom Caspi
Institute of Psychiatry, University of London
and University of Wisconsin—Madison

Phil A. Silva
University of Otago Medical School

Disorders from the *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed., rev.; American Psychiatric Association, 1987) were assessed in a birth cohort of 961 young adults. Comorbid cases exceeded single-disordered cases in chronic history of mental illness, use of treatments, physical health problems, functional interference in daily life, and impaired adaptation across domains such as work, education, health, and social-support networks. Single-disorder cases were also more impaired than nondisordered cases, but comorbid cases were the most severely impaired. Our findings suggest that (a) samples that underrepresent comorbidity (pure single-disorder cases or student samples) will underestimate effect sizes for relations between a disorder and its correlates, whereas samples that overrepresent comorbidity (clinical or adjudicated samples) will overestimate effect sizes, (b) comorbidity is accompanied by complications that challenge treatment planning, compliance, and coordination of service delivery, and (c) comorbidity is associated with physical, educational, and economic problems that make it a broad societal concern.

Comorbidity, the concurrent diagnosis of two or more mental disorders within the same individual, occurs with great frequency in child, adolescent, and adult populations. Epidemiological studies show that half of all persons with mental disorders have more than one diagnosable disorder, and comorbidity rates are even higher in clinical samples (Clark, Watson, & Reynolds, 1995). Much of the research on comorbidity has been driven by nosological debates between "splitters favoring the division of the major classes of mental disorders descriptively into smaller units" and "lumpers favoring the search for commonalities in disorders," with both groups finding that "the most exciting aspects of the comorbidity puzzle probably lie in the question about its general nosological implications" (Wittchen, 1996, p. 7). Although we share this interest in comorbidity's nosological implications (Krueger, Caspi, Moffitt, & Silva, 1998), the present article has a more pragmatic purpose. In this study, we examined the implications of comorbidity for clinical treatment and for sample selection in research on psychopathology. Research on comorbidity has overlooked these two pragmatic concerns relative to its preoccupation with comorbidity's implications for nosological issues (but see Clarkin & Kendall, 1992; Shea, Widiger, & Klein, 1992). Regardless of whether the splitters or the lumpers ultimately win the nosological wars, practitioners are diagnosing patients and scientists are designating study groups by following diagnostic guidelines that generate comorbid cases. We sought to inform the work of practitioners and researchers as they contend with the implications of comorbidity.

Denise L. Newman, Department of Psychology, University of Wisconsin—Madison; Terrie E. Moffitt and Avshalom Caspi, Social, Genetic and Developmental Psychiatry Research Centre, Institute of Psychiatry, University of London, England, and Department of Psychology, University of Wisconsin—Madison; Phil A. Silva, Dunedin Multidisciplinary Health and Development Research Unit, University of Otago Medical School, Dunedin, New Zealand. Denise L. Newman is now at the Department of Psychology, University of Virginia.

This research was supported in part by Grants MH-45070 and MH-49414 from the National Institute of Mental Health, by the William T. Grant Foundation, by the William Freeman Vilas Trust and H. I. Romnes Fellowship at the University of Wisconsin, and by the New Zealand Health Research Council. We are grateful to Bob Krueger for his comments on this article and to the study members and their families for their participation.

Correspondence concerning this article should be addressed to Terrie E. Moffitt, Social, Genetic and Developmental Psychiatry Research Centre, Institute of Psychiatry, De Crespigny Park, London SE5 8AF England. Electronic mail may be sent to t.moffitt@iop.bpmf.ac.uk.

Implications of Comorbidity for Treatment

Some evidence suggests that cases with comorbid conditions differ from single-disorder cases in clinically consequential ways. Compared with uncomplicated symptom presentations, comorbid presentations have a more chronic course, poorer prognosis, and tend to be less responsive to treatments (Brown & Barlow, 1992; Shea et al., 1992; Verhulst & van der Ende, 1993). In this study, we compared individuals with comorbid and single-disordered cases on several indicators of psychiatric impairment that have not, to our knowledge, been previously studied in relation to comorbidity; among them were self-rated interference in daily activities, self-reported help seeking, disability from work, and an informant's report that the study member was known to have a mental health problem.

Beyond the course and severity of illness symptoms, less is known about how comorbidity affects individuals' functioning in other behavioral domains that are of clinical concern. To inform clinical-treatment concerns, we investigated the residential mobility, economic status, educational attainment, ties to family, and social-support networks of individuals who have comorbid cases as compared with single-disorder cases. To our knowledge, these factors, which may influence both patients' ability to obtain treatment and the efficacy of treatment, have not been studied in relation to comorbidity.

Little is known about how comorbidity among mental disorders affects society more broadly, as opposed to how it affects individual patients. Research on general health care shows that per capita medical expenditure for persons with comorbid medical conditions is 1.5 times higher than for persons with one limiting condition, and 5 times higher than for persons without a disabling illness (Rice & LaPlante, 1992). The relative cost to society of comorbidity among mental disorders specifically requires further study. Furthermore, the impact of comorbid mental disorders on individuals' productivity and functioning in social roles is unknown. In this article, we describe the life functioning of young adults who have comorbid mental disorders across a variety of domains that are relevant to their successful assumption of productive adult roles. We focused on education and work roles, criminal involvement, welfare dependence, use of mental health services, and physical health. We asked whether individuals with comorbid cases exert a greater strain on societal resources than individuals identified with only one mental disorder.

Implications of Comorbidity for Sample Selection

Most studies of psychopathology focus on disorders one by one, and researchers often screen out comorbid cases to obtain pure cases for study. However, significant rates of comorbidity in the general population raise a critical question for sample selection: Must comorbid cases be included at the population-prevalence rate in the study sample?

Comorbidity may confound clinical trials designed to test the efficacy of treatments for a specific disorder and may also confound developmental studies intended to document the origins and clinical course of a specific disorder (Sher & Trull, 1996). If comorbid cases are under- or overrepresented in such studies relative to the general population, researchers must consider the extent to which findings can be generalized to the population of persons with the disorder. Even if comorbid cases are represented accurately in such studies, researchers must consider how to analyze potentially different results for such cases. Decisions about sample selection and data analysis must be informed by knowledge of *how much* comorbid versus pure cases differ on variables commonly examined in psychopathology research. We investigated whether pure and comorbid cases differ enough to compromise generalization of findings. We also compared individuals with comorbid and pure cases on their treatment experiences, educational enrollment, and court records to inform researchers about the implications of drawing research samples from clinical settings, college classrooms, and correctional settings.

In this study, we limited our comparisons to three simple groups—nondisordered, single-disorder, and comorbid cases. By assigning all comorbid cases to one comparison group, we did not examine specific combinations of comorbidity, which are sometimes referred to as "dual diagnoses." This is because comorbid cases do not primarily present in pairs of dual diagnoses. In our epidemiological study (Newman et al., 1996), although 47% of diagnosed cases met criteria for more than one disorder, only 21% of diagnosed cases met criteria for just two disorders, whereas 26% met criteria for three or more disorders. The term *comorbidity* may be an oversimplification, if not a misnomer, because 56% of "comorbid" cases in our cohort had three or more disorders. Of those "trimorbid" cases 53% had four or more disorders, and of the "quatromorbid" cases 53% had five or more diagnoses.

In addition, we studied comorbid cases who met the criteria for at least one disorder in two or more different classes or families of diagnoses (e.g., anxiety and mood disorders; mood and substance disorders) from the *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed., rev.; *DSM–III–R;* American Psychiatric Association, 1987) rather than those who met criteria for two or more disorders within a single diagnostic family (e.g., social and simple phobia within the anxiety family). We did this because *cross-family diagnostic comorbidity*—which poses the greatest nosological conundrum—also has especially important implications for planning treatment and research. With regard to clinical treatment, patients are often attended to in settings that specialize in one family of disorders (e.g., anxiety disorders clinics, substance abuse centers). With regard to sample selection, researchers who study pure cases (e.g., major depression) tend to screen out cases who meet diagnostic criteria for disorders in other diagnostic families (substance disorders) but not those who meet criteria for disorders in the same family (e.g., dysthymia).

Method

Sample

Participants are members of the Dunedin Multidisciplinary Health and Development Study, a longitudinal investigation of the health, development, and behavior of a complete cohort born between April 1, 1972 and March 31, 1973 in Dunedin, a city on New Zealand's South Island. When the birth cohort was first traced for follow-up at the age of 3 years, 91% of the eligible births participated in the assessment, providing a base sample of 1,037 children (52% boys and 48% girls). The cohort was reassessed at ages 3, 5, 7, 9, 11, 13, 15, 18, and 21. At the age of 21 years, 961 study members participated in the assessment. Details about the study are provided by Silva and Stanton (1996), and analyses of representativeness and attrition have been recently published in the *Journal of Abnormal Psychology* (Krueger et al., 1998).

Measures

Diagnosis of mental disorders. Diagnoses were determined using the Diagnostic Interview Schedule (Robins, Helzer, Croughan, & Ratcliff, 1981). The reporting period was the past 12 months. Assessment procedures, reliability, and prevalence rates for the *DSM–III–R* diagnoses have been described elsewhere (Newman et al., 1996). The rates of mental disorders in the Dunedin sample closely match rates reported for people of similar ages in U.S. surveys (Kessler et al., 1994).

The 15 disorders diagnosed at age 21 were grouped into six diagnostic

families that combine diagnoses along the chapter groupings found in the *DSM–III–R*. These included the following: (a) 6 *anxiety disorders:* generalized anxiety disorder, obsessive–compulsive disorder, panic disorder, agoraphobia, social phobia, and simple phobia; (b) 3 *mood disorders:* major depressive episode, manic episode, and dysthymia; (c) 2 *substance disorders:* alcohol dependence and marijuana dependence; (d) 2 *eating disorders:* anorexia nervosa and bulimia nervosa; (e) 1 *personality disorder:* antisocial personality disorder; and (f) 1 *psychotic disorder:* nonaffective psychosis, which consisted of the positive symptoms of schizophrenia and schizophreniform disorders.

Identification of comorbid cases. Comorbidity was defined as meeting the full criteria for at least one diagnosis in each of two or more of the six diagnostic families described previously. Three comparison groups of cases were identified: (a) *Nondisordered* cases did not meet criteria for any diagnosis of a mental disorder at age 21 (N = 572; 53% men). (b) *Single-disorder* or pure cases met criteria for only one disorder family (N = 237; 51% men). Of these pure cases, only 14% met criteria for two or more diagnoses *within* a diagnostic family; thus, over 85% of the pure cases truly represent a single disorder. (c) *Comorbid* cases met criteria for *DSM–III–R* disorders across two or more of the six families of disorders (N = 152; 46% men). There were no significant gender differences in the distribution of cases assigned to these three groups, $\chi^2(2, N = 961) = 2.10$, $p = .35$.

Measures of impairment and social adaptation. Using a reporting period of the past 12 months, participants were asked if they had sought general medical, psychiatric, psychological, or other *services* for psychiatric symptoms. They were also asked about *hospitalizations* for psychiatric symptoms and any *psychotropic medications* taken that year.

We measured the significance of impairment that occurred during the 1-year reporting period using five indexes: (a) Respondents were asked about *suicide attempts* made within the past year. Attempts were counted whether or not medical attention was required. (b) For each of the six families of disorders for which respondents reported any symptom, they were asked to rate the global *level of interference* they experienced in work and daily activities associated with their symptoms. The Likert scale ranged from 1 (*very little*) to 5 (*very much*), and interference was scored as the mean across the six interference ratings (one rating for each family of disorders). (c) *Months of disability* due to mental or emotional problems were measured with the Life History Calendar (LHC; Caspi et al., 1996), a calendar-structured interview used to obtain reliable retrospective event-history data from study members from ages 15 to 21. (d) *Informant report of maladjustment* (α = .78) was based on responses to a mail questionnaire completed by informants nominated by the study members as "someone who knows you well." Of the nominated informants, 95% returned the questionnaires, which had 13 items describing principal signs of each of the major families of mental disorders worded in a general manner such as "Feeling depressed, miserable, sad or unhappy," "Problems related to the use of alcohol," or "Doing things against the law such as stealing or vandalism." The index is the sum of 13 items rated 0 (*does not apply*), 1 (*yes, applies somewhat*), and 2 (*yes, definitely applies*). (e) The *Life Satisfaction Scale* (α = .80) is the sum of nine items asking the respondents to assess satisfaction with their lives.

Indicators of *age of onset* and *adolescent history* of psychiatric disorder were obtained from the prospective diagnostic assessments conducted at ages 11, 13, 15, 18, and 21. These indicators are described in Newman et al.'s (1996) article. At ages 11 to 15, the Dunedin study used the Diagnostic Interview for Children–Children's Version (DISC-C; Costello, Edelbrock, Kalas, Kessler, & Klaric, 1982) to identify 12 *DSM–III* disorders. At age 18, the diagnostic protocol was the same as at age 21.

Lifestyle variables included, from the LHC, the *number of residence changes* between ages 15 and 21, current number of sources of government *welfare aid* received, and presence of a *criminal conviction record.* The latter was obtained with informed consent from the computerized records of the New Zealand and Australian court systems.

Workforce variables included, from the LHC, the percentage of cases experiencing long-term (6 months or more) *unemployment* since leaving secondary school and two scales measuring quality of work experience: *Job Satisfaction* (18 items; α = .85) assesses the affective evaluation of one's job. *Emotional Work Strain* (7 items; α = .61) assesses the degree of emotional strain experienced on the job because of interpersonal strife, role overload, and ambiguous task demands (Newman, Caspi, Moffitt, & Silva, 1997).

Education variables obtained from study members included the self-reported *age they left high school*, their *highest educational attainment*, and the percentage of members who had enrolled as *students in a 4-year college* or university by age 21.

Physical health variables included a count of the number and types of 15 *medical conditions* (e.g., diabetes, heart condition, cancer, migraines, hepatitis) for which study members reported receiving treatment in the past year, and from the LHC, reports about the number of months of *disability due to physical illness* and due to *injury.*

We assessed four types of social support (Newman et al., 1997). *Material or Practical Assistance* (7 items; α = .79) measured the number of people who would help with financial or physical assistance when needed. *Companionship* (7 items; α = .84) measured the number of people who share interests and provide companionship for pleasurable activities. *Nurturance and Emotional Support* (14 items; α = .91) measured the number of people who provide lasting affiliation, love, comfort, and are available to confide in. *Mentorship and Guidance* (9 items; α = .86) measured the number of people who advise, teach, recommend, or otherwise help smooth the way in navigating the world. In addition, *family attachment* was assessed by showing respondents a diagram with six concentric rings, asking them to imagine that their family was in the center, and then asking them to locate themselves in one of the rings. Rings further from the center represented decreasing degrees of involvement or attachment. The exercise was repeated for *peer attachment* to assess involvement with friends.

Results

Of the 389 study members meeting criteria for one or more *DSM–III–R* disorders, 152 (39%) met criteria for inclusion in the comorbid group as defined by the co-occurrence of two or more disorders across the six diagnostic family groups of anxiety, mood, substance, antisocial personality, psychotic, and eating disorders. Comorbidity was the rule within each family, characterizing 57% of the 195 participants with an anxiety disorder, 66% of the 179 participants with a mood disorder, 51% of the 155 participants who were substance dependent, 74% of the 31 participants with antisocial personality, 85% of the 39 participants with a psychosis, and 85% of the 13 participants with an eating disorder. Of the 152 study members who constituted the comorbid group for this study, 73% had anxiety disorder, 78% had mood disorder, 52% were substance dependent, 15% had antisocial personality, 22% had psychotic symptoms, and 7% had an eating disorder. Of the 237 study members who constituted the pure group, 35% had anxiety disorder as their single diagnosis family, 26% had mood disorder, 32% were substance dependent, 3% had antisocial personality, 3% had psychotic symptoms, and 1% had an eating disorder. Thus, both the comorbid and the pure groups, like the sample as a whole, were dominated by anxiety, mood, and substance disorders.

Table 1 shows that comorbid cases were far more likely than pure and nondisordered cases to have used mental health ser-

Table 1
Mental Health Status of Nondisordered, Single-Disorder, and Comorbid Psychiatric Participants

Mental health measure	No disorder (n = 572)	Single disorder (n = 237)	Comorbid (n = 152)	F or χ^2
Treatment within past year				
Mental health services sought (%)	7.7	15.3_a	$40.8_{a,b}$	101.72*
Psychiatric hospitalization (%)	0.5	0.9	$6.8_{a,b}$	30.90*
Psychotropic medication taken (%)	1.2	3.8_a	$14.9_{a,b}$	56.55*
Significance of impairment				
Suicide attempts in past year (%)	0.5	1.3_a	$8.6_{a,b}$	40.04*
Disorder interferes with daily activities (Z)	−0.35	0.20_a	$0.92_{a,b}$	129.86*
Months disabled because of psychiatric illness	0.21 (2.16)	0.23 (2.17)	$1.63\ (6.12)_{a,b}$	12.81*
Informant report of maladjustment (Z)	−0.22	0.11_a	$0.73_{a,b}$	54.22*
Life satisfaction scale (Z)	0.17	-0.12_a	$-0.46_{a,b}$	22.67*
Developmental onset				
Mean age of onset of disorder (years)	—	16.46 (4.03)	$14.66\ (3.82)_b$	$t(387) = 4.44$*
Adolescent history of disorder (%)	40.0	65.8_a	$86.2_{a,b}$	121.48*

Note. Means for dimensional scales are standardized Z scores ($M = 0$, $SD = 1.0$). % refers to the percentage of participants. The original metric for variables describing time or age has been maintained, and standard deviations are shown in parentheses. A subscript a indicates that a group differs significantly ($p < .05$) from the nondisordered group. A subscript b indicates that a group differs significantly ($p < .05$) from the single-disorder group. A dash indicates that no comparison was made for the group because it did not meet criteria for a disorder at age 21 years; degrees of freedom were adjusted accordingly.
* $p < .01$.

vices in the past year, including hospitalization and psychotropic medications. Compared with pure and nondisordered cases comorbid cases reported far more impaired functioning on every measure, from suicide attempts to disruption of performance in daily activities, spells of disability, and greater life dissatisfaction. These self-reports were corroborated by their social reputation for greater maladjustment. The developmental history of mental illness in comorbid cases was distinguished by a more chronic course of illness than in pure cases: Comorbid cases had a mean age of onset nearly 2 years earlier, and 86% of them had a history of prospectively assessed disorder during adolescence.

Table 2 shows that comorbid cases were functioning at lower levels than nondisordered cases across multiple life domains. In many areas, the comorbid cases were also functioning at significantly lower levels than pure cases. Comorbid cases consistently evidenced less social stability: They had a history of more residence changes, relied more on sources of government welfare for financial support, were more likely to have adult criminal conviction records, and were more likely to suffer long-term unemployment. As part of the workforce, comorbid cases reported less job satisfaction than nondisordered cases and more job-related emotional strain than both the pure and nondisordered controls. With regard to educational achievement, both groups with psychiatric disorders at age 21 tended to leave school half a year earlier and attained fewer qualifications than their nondisordered peers, and significantly fewer comorbid cases continued on to a 4-year college or university. Overall, comorbid cases had the lowest level of educational attainment compared with the pure and nondisordered cases. The comorbid group also suffered the greatest number of concurrent physical health problems that required treatment and had been disabled longer because of physical illness. Both groups with psychiatric disorders had been disabled longer by injuries than the nondisordered group. With regard to social support, the comorbid group did not differ from pure or nondisordered groups on measures of material or practical support, and the three groups did not differ in their levels of companionship and attachment to their peer network. However, on the measure of attachment to family and on perceptions of support from others who might provide emotional comfort, the comorbid group fell significantly below the mean levels reported by the nondisordered group. The pure group also reported lower levels of family attachment than the nondisordered group. In addition, both disordered groups reported significantly less support from persons who might provide mentorship, guidance, or, through connections, access into the job market.[1]

Discussion

The findings from this study suggest that psychiatric comorbidity has significant consequences for how patients should be treated and for how research samples should be selected. However, certain methodological limitations precluded a more complete understanding of the implications of comorbid mental disorders. First, we were unable to assess the full spectrum of possible mental disorders because of time constraints in the assessment program, our expectations of very low base rates in

[1] We may have slightly overestimated problems associated with pure disorders, because we defined single-disorder cases as those who had diagnoses within only one disorder family; some individuals in the single-disorder group had concurrent diagnoses within a family, such as panic disorder plus social phobia or alcohol dependence plus marijuana dependence. Thus, we repeated all the analyses after eliminating the 32 single-disorder cases (14% of a possible 237 cases) who had multiple disorders within a family. All the results in the tables were unchanged in their substantative and statistical significance with one exception: The pairwise contrast between pure and nondisordered cases was no longer significant for the attachment-to-family measure.

Table 2
Comparison of Nondisordered, Single-Disorder, and Comorbid Participants on Measures of Concurrent Functioning

Domain	No disorder (n = 572)	Single disorder (n = 237)	Comorbid (n = 152)	F or χ^2
Lifestyle factors				
Residence changes (N)	5.06 (3.48)	6.05 (4.15)$_a$	7.36 (5.20)$_{a,b}$	21.52*
Sources of government aid (N)	0.41 (0.62)	0.50 (0.67)	0.71 (0.74)$_{a,b}$	12.95*
Criminal conviction record (%)	8.4	18.1$_a$	28.9$_{a,b}$	46.39*
Workforce				
Long-term unemployment (%)	26.1	28.9	44.4$_{a,b}$	19.04*
Job satisfaction scale (Z)	0.14	−0.18$_a$	−0.26$_a$	14.89*
Emotional strain on job (Z)	−0.19	0.14$_a$	0.50$_{a,b}$	33.87*
Education				
Age when they left school (years)	17.93 (2.01)	17.50 (2.01)$_a$	17.46 (2.16)$_a$	5.46*
Enrolled in college (%)	27.6	19.4	17.1$_a$	10.83*
Highest level attained (Z)	0.16	−0.08$_a$	−0.28$_{a,b}$	14.13*
Physical health				
Concurrent medical problems (N)	0.61 (0.84)	0.81 (0.98)$_a$	1.29 (1.19)$_{a,b}$	31.23*
Months disabled because of illness	0.44 (3.07)	0.66 (3.76)	1.63 (6.31)$_{a,b}$	5.39*
Months disabled because of injury	0.81 (3.35)	1.72 (5.92)$_a$	2.10 (6.92)$_a$	5.88*
Social support				
Material or practical assistance (Z)	0.04	−0.06	−0.08	1.44
Companionship (Z)	0.00	0.01	0.00	0.03
Nurturance, emotional support (Z)	0.07	−0.03	−0.20$_a$	4.59*
Mentorship and guidance (Z)	0.09	−0.13$_a$	−0.13$_a$	5.78*
Attachment to family (Z)	0.11	−0.05$_a$	−0.34$_{a,b}$	13.71*
Attachment to peers (Z)	−0.02	0.04	0.00	0.31

Note. Means for dimensional scales are standardized Z scores (M = 0, SD = 1.0). % refers to the percentage of participants. The original metric for variables describing the numbers of incidents (N), time in months, or age in years has been maintained, and standard deviations are shown in parentheses. A subscript a indicates that a group differs significantly ($p < .05$) from the nondisordered group. A subscript b indicates that a group differs significantly ($p < .05$) from the single-disorder group.
* $p < .01$.

this age group for certain disorders, and the limits of self-report interviews for obtaining certain diagnostic criteria. Despite these omissions, the prevalence rate of comorbid cases in the Dunedin birth cohort was consistent with that of other surveys (Kessler et al., 1994). Second, we did not analyze specific combinations of comorbidity. Despite our sizeable sample, the base rates of some disorder combinations were too small to reliably examine specific patterns of dual diagnoses. Moreover, psychiatric disorders did not present in tidy pairs; more than 50% of comorbid cases met criteria for three, four, or even more disorders. Third, we limited our study to young adults, the sector of the population with peak prevalence rates of mental disorders (Institute of Medicine, 1994). Although high rates of comorbidity have been reported across the lifespan (Kessler et al., 1994; Lewinsohn, Hops, Roberts, Seeley, & Andrews, 1993), the implications of comorbidity for other age groups could be different from those reported here for young adults. Fourth, the correlational design of this study precludes causal inferences about the relation between comorbidity and functional impairment. Is a breakdown in lifestyle a consequence of having multiple disorders or does a breakdown in lifestyle trigger the onset of multiple disorders (or prevent their remission)? A related developmental issue is the temporal aspect of comorbid mental disorders. The conception of comorbidity used in this study is cross-sectional in that it refers to the co-occurrence of disorders within a 1-year reporting period. Longitudinal comorbidity, in which individuals experience multiple disorders in sequence, is another target for epidemiological and etiological investigations (Caron & Rutter, 1991).

Implications of Comorbidity for Sample Selection

Our findings suggest that the common research practice of screening out comorbid cases to focus on pure cases may yield results that cannot be generalized to all possible configurations of a particular disorder (Sher & Trull, 1996). Comparisons of pure cases to nondisordered controls yielded much smaller effect sizes than comparisons of comorbid cases to nondisordered controls. As evidence, the mean difference between healthy controls and single-disorder cases across the 19 variables we measured with continuous scales was .20 SD, which is conventionally considered a small effect size (Cohen, 1988). By contrast, the mean difference between healthy controls and comorbid cases across the 19 variables was .43 SD, a medium effect size (Cohen, 1988). Previously we reported that comparisons to nondisordered controls on personality measures also yield small-to-medium effects for pure cases but medium-to-large effects for comorbid cases (Krueger, Caspi, Moffitt, Silva, & McGee, 1996). It appears that if comorbid cases are screened out in the interest of focusing a study on pure cases, researchers will need to recruit much larger samples to ensure statistical power to detect small effects.

Alternatively, if comorbid cases are not screened out of research samples, variance on measures will more faithfully repre-

sent the full population range, effect sizes will be somewhat larger, and somewhat smaller samples will have the power to detect them. However, when comorbid cases are not culled from research samples, a statistical strategy will be needed to surmount the confounding effects of multiple disorders before interpreting the unique effects for a particular target disorder of interest. Put another way, the *specificity* of a marker for a disorder will be obscured in a sample that includes comorbid cases, because it will be unclear whether that marker relates to the particular disorder of interest or to another syndrome that covaries with it (Garber & Hollon, 1991; Sher & Trull, 1996).

Our findings underscore another consideration for sample selection in psychopathology research: The settings in which research participants are recruited matter a lot. Using clinical populations will lead to inadvertent oversampling of comorbid cases because the effects of joint probabilities of multiple disorders on entering treatment increase the likelihood that comorbid cases will fill clinical settings (Berkson, 1946). In our sample, comorbid cases were about 7 times more likely than single-disorder cases to have been hospitalized in the past year. As such, a comparison of clinically presenting cases versus healthy controls may result in grossly *overestimated* effect sizes if the clinical sample contains disproportionate numbers of individuals who are severely impaired by comorbid disorders. Earlier we noted that our data suggest that the effect sizes obtained from comparisons of healthy individuals versus individuals with pure diagnoses are too small to generalize to the population, but our data also clearly demonstrate that the effect sizes obtained from comparisons of healthy controls versus clinical groups laden with comorbid individuals are probably too large to generalize to the population. Studies of clinical samples may routinely exaggerate the implications of mental illness, a phenomenon known as the clinician's illusion (Cohen & Cohen, 1984). Put another way, estimates of the *sensitivity* of a marker for a disorder will be inflated if the marker was identified first in a clinical sample laden with comorbid individuals, producing errors in subsequent clinical use of the marker.

Comorbidity poses similar problems in other settings where psychopathology research is typically conducted. Our finding of more criminal convictions among comorbid cases suggests that the prison setting, like the clinic, has inflated rates of comorbid cases. If comorbidity is not addressed, comparisons of adjudicated samples versus controls may overestimate the strength of the correlates of antisocial disorders. Such a discrepancy between findings from adjudicated versus community samples has long been observed by criminologists (Hindelang, Hirschi, & Weis, 1979) and should be heeded by psychopathologists. In contrast, our finding that fewer comorbid cases enroll in 4-year colleges suggests that samples of college students, for example, those used in depression studies (Tennen, Hall, & Affleck, 1995; Vredenburg, Flett, & Krames, 1993), will likely yield smaller effect sizes than samples that represent the population.

As an illustration, consider the relation between psychiatric problems and medical problems. In the Dunedin study, which represents the population distribution of pure and comorbid cases as well as nondisordered controls among young adults, the correlation between the number of symptoms of depression and the number of concurrent medical problems in the full sample was .23. What would happen, however, if a researcher conducted a study of depression and medical problems among young adults but screened out comorbid cases to obtain pure cases of depression? To find out, we correlated symptoms of depression and concurrent medical problems after excluding comorbid cases from the analysis. The correlation dropped to .15. Conversely, what would happen if a researcher conducted a study of depression and medical problems but selected a sample from a clinical setting, where comorbid cases are overrepresented by a factor potentially as high as 7? To find out, we correlated symptoms of depression and concurrent medical problems in our sample after overweighting comorbid cases by a factor of 5. The correlation increased to .32. Not every researcher will have access to a sample that fully represents the population distribution of comorbid disorders, but every researcher can inform research consumers about whether his or her findings are likely to under- or overestimate true effect sizes for the general population.

Implications of Comorbidity for Treatment

Our findings suggest that comorbid diagnoses should alert the clinician to potential complicating factors that may impede treatment progress. Comorbid cases are likely to be more resistant to treatment because of the early onset and longstanding nature of their mental illnesses and because of the polymorphous nature of their life problems. Comorbid disorders are linked with lifestyle factors, such as job stress, physical illness, frequent moving, lack of social support, weak ties to family, unemployment, and welfare dependence, that may exacerbate symptoms and impede compliance with treatment regimens, and thereby may retard recovery (Armbruster & Kazdin, 1995). Comorbid cases are also more likely to have simultaneous involvement with the social welfare system, the justice system, and the health care system. In light of the likelihood of involvement with multiple service-delivery agencies, coordinating services is an important consideration. At the same time, comorbid cases are less likely to be involved with social systems that are normally supportive of individual functioning, such as the college or university, the workplace, and the family. Clinicians should understand that comorbid patients will have fewer external support systems to be adjuncts to their treatment.

We have shown that comorbid cases presenting for treatment are likely to have more complications than cases identified with a single disorder. As a result, broad-band approaches to treatment may be indicated. Many therapies are narrowly targeted for specific symptoms (e.g., desensitization for phobias, cognitive therapy for depressive thoughts, nutritional contracts for eating disorders, social skills training for conduct problems). Such single-disorder interventions seem unlikely to produce successful recovery of global functioning among comorbid cases. Yet, if comorbid cases are the most severely impaired, as our data suggest, they are in greatest need of treatment. Comorbid diagnoses should prompt the clinician to investigate further the full scope of a patient's life impairment and to develop multimodal treatment plans accordingly. Although comorbid cases may require long-term multimodal treatments which are expensive, the cost to the individual and to society of ignoring such regimens may ultimately be far more expensive.

The nosological implications of high rates of comorbid mental

disorders have been recognized for some time (Wittchen, 1996). Our findings, and the findings of others, suggest that there are also important implications of comorbidity for sample selection and clinical treatment. Our findings illustrate that samples that underrepresent comorbid cases (pure cases or student samples) will underestimate relations between variables, whereas samples that overrepresent comorbid cases (clinical or adjudicated samples) will overestimate empirical relations. Our finding that comorbidity is accompanied by many complicating life circumstances suggests that comorbid diagnoses pose serious challenges for clinical treatment planning, treatment compliance, and coordination of service delivery. Finally, our finding that comorbidity is associated with multiple physical, educational, legal, and economic problems suggests that although diagnosis with a single mental disorder may be an individual's problem, comorbid mental disorders constitute a broader societal problem.

References

American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed., rev.). Washington, DC: Author.

Armbruster, P., & Kazdin, A. E. (1995). Attrition in child psychotherapy. In T. H. Ollendick & R. J. Prinz (Eds.), *Advances in clinical child psychology* (pp. 50–83). New York: Plenum.

Berkson, J. (1946). Limitations of the application of the fourfold table analysis to hospital data. *Biometrics, 2,* 47–53.

Brown, T. A., & Barlow, D. H. (1992). Comorbidity among anxiety disorders: Implications for treatment and *DSM–IV. Journal of Consulting and Clinical Psychology, 60,* 835–844.

Caron, C., & Rutter, M. (1991). Comorbidity in child psychopathology: Concepts, issues, and research strategies. *Journal of Child Psychology and Psychiatry, 32,* 1063–1080.

Caspi, A., Moffitt, T. E., Thornton, A., Freedman, D., Amell, J. W., Harrington, H., Smeijers, J., & Silva, P. A. (1996). The Life History Calendar: A research and clinical assessment method for collecting retrospective event-history data. *International Journal of Methods in Psychiatric Research, 6,* 101–114.

Clark, L. A., Watson, D., & Reynolds, S. (1995). Diagnosis and classification of psychopathology: Challenges to the current system and future directions. *Annual Review of Psychology, 46,* 121–153.

Clarkin, J. F., & Kendall, P. C. (1992). Comorbidity and treatment planning: Summary and future directions. *Journal of Consulting and Clinical Psychology, 60,* 904–908.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences.* Hillsdale, NJ: Erlbaum.

Cohen, P., & Cohen, J. (1984). The clinician's illusion. *Archives of General Psychiatry, 41,* 1178–1182.

Costello, A., Edelbrock, C., Kalas, R., Kessler, M., & Klaric, S. (1982). *National Institute of Mental Health Diagnostic Interview Schedule for Children.* Rockville, MD: National Institute of Mental Health.

Garber, J., & Hollon, S. (1991). What can specificity designs say about causality in psychopathology research? *Psychological Bulletin, 110,* 129–136.

Hindelang, M. J., Hirschi, T., & Weis, J. G. (1979). Correlates of delinquency: The illusion of discrepancy between self-report and official measures. *American Sociological Review, 44,* 995–1014.

Institute of Medicine, Committee on Prevention of Mental Disorders, Division of Biobehavioral Sciences and Mental Disorders. (1994). *Reducing risks for mental disorders: Frontiers for preventive intervention research.* Washington, DC: National Academy Press.

Kessler, R. C., McGonagle, K. A., Zhao, S., Nelson, C. B., Hughes, M., Eshleman, S., Wittchen, H. U., & Kendler, K. S. (1994). Lifetime and 12-month prevalence of *DSM–III–R* psychiatric disorders in the United States: Results from the National Comorbidity Study. *Archives of General Psychiatry, 51,* 8–19.

Krueger, R. F., Caspi, A., Moffitt, T. E., & Silva, P. A. (1998). The structure and stability of common mental disorders (*DSM–III–R*): A longitudinal–epidemiological study. *Journal of Abnormal Psychology, 107,* 216–227.

Krueger, R. F., Caspi, A., Moffitt, T. E., Silva, P. A., & McGee, R. (1996). Personality traits are differentially linked to mental disorders: A multi-trait/multi-diagnosis study of an adolescent birth cohort. *Journal of Abnormal Psychology, 105,* 299–312.

Lewinsohn, P. M., Hops, H., Roberts, R. E., Seeley, J. R., & Andrews, J. A. (1993). Adolescent psychopathology: I. Prevalence and incidence of depression and other *DSM–III–R* disorders in high school students. *Journal of Abnormal Psychology, 102,* 133–144.

Newman, D. L., Caspi, A., Moffitt, T. E., & Silva, P. A. (1997). Antecedents of adult interpersonal functioning: Effects of individual differences in age-3 temperament. *Developmental Psychology, 33,* 206–217.

Newman, D. L., Moffitt, T. E., Caspi, A., Magdol, L., Silva, P. A., & Stanton, W. R. (1996). Psychiatric disorder in a birth cohort of young adults: Prevalence, comorbidity, clinical significance, and new case incidence from ages 11 to 21. *Journal of Consulting and Clinical Psychology, 64,* 552–562.

Rice, D. P., & LaPlante, M. P. (1992). Medical expenditures for disability and disabling comorbidity. *American Journal of Public Health, 82,* 739–741.

Robins, L. N., Helzer, J. E., Croughan, J., & Ratcliff, K. S. (1981). National Institute of Mental Health Diagnostic Interview Schedule: Its history, characteristics, and validity. *Archives of General Psychiatry, 38,* 381–389.

Shea, M. T., Widiger, T. A., & Klein, M. H. (1992). Comorbidity of personality disorders and depression: Implications for treatment. *Journal of Consulting and Clinical Psychology, 60,* 857–868.

Sher, K. J., & Trull, T. J. (1996). Methodological issues in psychopathology research. *Annual Review of Psychology, 47,* 371–400.

Silva, P. A., & Stanton, W. R. (Eds.). (1996). *From child to adult: The Dunedin Multidisciplinary Health & Development Study.* Auckland, New Zealand: Oxford University Press.

Tennen, H., Hall, J. A., & Affleck, G. (1995). Depression research methodologies in the *Journal of Personality and Social Psychology:* A review and critique. *Journal of Personality and Social Psychology, 68,* 870–884.

Verhulst, F. C., & van der Ende, J. (1993). Comorbidity in an epidemiological sample: A longitudinal perspective. *Journal of Child Psychology and Psychiatry, 34,* 767–783.

Vredenburg, K., Flett, G. L., & Krames, L. (1993). Analogue versus clinical depression: A critical appraisal. *Psychological Bulletin, 113,* 327–344.

Wittchen, H. (1996). Critical issues in the evaluation of comorbidity of psychiatric disorders. *British Journal of Psychiatry, 168,* 9–16.

Received January 13, 1997
Revision received September 24, 1997
Accepted December 2, 1997 ■