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Comment

Donald Guthrie

Psychiatry may be unique among the medical disciplines in the breadth of its scientific collaboration. Research in psychiatry includes components from the biological, medical, behavioral, physical, and social sciences. Their mixture provides an ideal working environment for a statistician with interests in diverse application experiences. Brian Everitt is one of the best known and highly respected statisticians with application interests in psychiatry. His collaboration with Michael Rutter, for example, has led to significant extensions of understanding in child psychiatry.

Everitt is to be commended for providing enlightening and entertaining insight into the role of statisticians in psychiatric research. He has accurately described some of the more rewarding aspects (collab-

oration on interesting scientific problems) and some of the more frustrating aspects (unwillingness to seek and accept statistical advice). I have had similar experience to Everitt's in reading and contributing to the psychiatric literature. First, I find that there tends to be an obsession with p values and other mechanistic approaches to data interpretation. Second, I share the concern over more-or-less blind use of packaged programs by naive users. It is, I believe, unfair to accuse the psychiatrists I know of making these errors, but the correct blame may lie with those who provide support which should be supplied by statisticians. Most psychiatrists are quite eager to seek and accept expert opinion from statisticians.

Everitt has illustrated applications of Cox regression in his two examples. These examples are illustrative but by no means exhaustive. Statisticians are useful in virtually all aspects of psychiatric research. Let me consider a few additional examples, all of which involve substantial contributions by and from statisticians.

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One of the most recent developments in psychiatry has been the formalization of psychiatric diagnosis through the classification of psychiatric illness. The adoption by the American Psychiatric Association of the diagnostic criteria of the third edition of the *Diagnostic and Statistical Manual* (known as DSM-III) set the stage for objective classification of disease and for research on the validity and reliability of such classification. Measurement of mental status is a very complex process, and research in measurement requires carefully planned experimentation. A statistician enters these studies early in their planning.

Psychiatric epidemiology, studies of the medical, behavioral, genetic, and social correlates of mental health and illness, has developed as a subdiscipline of both psychiatry and epidemiology. For example, psychiatric epidemiologists have studied extensively the relationships among living and working conditions and mental health. Statistical methods applied in psychiatric epidemiology rely heavily on statistical methods such as logistic regression and log-linear models, path analysis and latent variable models, and multivariate analysis.

Genetic studies have contributed to the understanding of the source and cause of mental illness. It has long been recognized, for example, that there are strong familial aspects of schizophrenia, and recently genes have been located which appear to be associated with bipolar affective disorders. Statistical methods include most of those common to genetic analyses, with extensive use of probability modeling and goodness-of-fit testing.

Everitt has cited clinical trials for the study of effectiveness of treatment modalities; issues of experimental design are especially sensitive in these trials since both medical and behavioral components may be involved. For example, the comparative effectiveness of alternate modes of psychotherapy has been studied extensively.

Electrophysiology includes the study of the electrical behavior of the nervous system. A typical electrophysiological experiment generates massive amounts of data over very short time intervals. The reduction of this data to interpretable form is essential to the success of the research. Methods of time series analysis have been used, for example, to evaluate brain activity during periods of sleep and waking. Everitt correctly observes that imaging offers many challenging problems for statisticians.

All of these studies require participation by a collaborator with statistical skills. Quite frequently, this individual does not bear the professional title of stat-

istician and may not have the statistical background to make the quantitative judgments necessary for successful conduct of the research. We statisticians who work in this field spend a lot of time reviewing manuscripts and research proposals, and we find "fatal" errors of statistical reasoning in too many of them. The psychiatric researcher has a wealth of challenging, but not impossible statistical problems; the applied statistician has a wealth of mathematically based statistical tools and the desire to see them properly applied. Too often, the two interests do not find one another.

Everitt has addressed the issue of the statistical training of psychiatrists, but has not said much about the training of statisticians for collaboration with psychiatrists. In the education of a statistician there is no substitute for a solid background in statistical theory and methodology. Indeed, this is the most frequent shortcoming of the consultants without statistical training. But there is also no substitute for learning statistical applications in the context of an application field. Once a statistician chooses a particular area of application, whether it be psychiatry or engineering, he or she must develop the ability to communicate in the language of that field. It is not necessary for a statistician to possess the full vocabulary of the psychiatrist or engineer, but he or she must be able to recognize situations which occur commonly. A statistician must develop enough self-assurance to interrupt directly but professionally a client who is not communicating effectively (cf. Everitt's example involving "visual cortex," "implanted electrodes," "phosphenes," and "ghosts") and the psychiatrist must be able to interrupt a statistician who is not making himself understood. Psychiatrists, by the very nature of their training, are generally better able to communicate effectively.

There are federally supported training programs in psychiatric statistics at Carnegie-Mellon and Columbia Universities designed to prepare predoctoral and postdoctoral statisticians for research in psychiatry. These programs offer student/trainees the opportunity to learn statistical methodology in the context of actual applications. In this way they contribute to the overall quality of statistical consultation and to the quality of research in psychiatry. A statistician who wishes to enter this field should consider these programs.

Because of its scientific diversity, its range of challenging problems, and its open acceptance of statisticians, psychiatry is an exciting application field. I share Everitt's enthusiasms.