PRESIDENTIAL ADDRESS—BIOMETRIC METHODS IN PSYCHOPATHOLOGY

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If we define biometrics as the science which applies measurement to the structures and functions of living organisms, it becomes quite apparent that the application of biometrics to psychopathology is still in its infancy. Certain aspects of psychopathology are still so deeply rooted in their descriptive stages that psychopathologic biometry is as unexpected a combination as is clinical-statistics.

The antipathy that formerly existed between biometrics and psychopathology may be laid at the door of the early biometricians like Pearson who, because of their vehement exposure of shortcomings in clinical research, alienated rather than captured the hearts of clinicians in general. A polemic approach, which either disproved the significance of an observed clinical difference or attributed its significance to some other uncontrolled variable, could not be counted on to win friends. Since much of psychopathology is still qualitative, unsuitable even for mere categorization, it is to be expected that biometricians who invade the field might be regarded with suspicion. There is sometimes a good basis for this suspicion, since the biometric methods that are now available are often unsuitable because the assumptions underlying them are not invariably satisfied by clinical data. Nevertheless, if scientific progress is to be made, the models around which the concepts and facts of psychopathology are to be fitted must eventually be of the quantitative variety, rather than of the impressionistic variety which is encountered so often in the clinical field. This, to be sure, is only a faith or a hypothesis, but historically it is the one which benefited most the advancement of knowledge. One of the clearest contrasts between the biometric and the impressionistic approach has been made by Galton, the father of Biometrics:

General impressions are never to be trusted. Unfortunately, when they are of long standing they become fixed, rules of life, and assume a prescriptive

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right, not to be questioned. Consequently, those who are not accustomed to
original inquiry entertain a hatred and horror of statistics. They cannot en-
dure the idea of submitting their sacred impressions to cold-blooded veri-
fication. But it is the triumph of scientific men to rise superior to such super-
stitions, to desire tests by which the value of beliefs may be ascertained, and
to discard contemptuously whatever may be found to be untrue.

Despite the primarily clinical orientation of psychopathology there
is a growing tendency today towards the utilization of quantitative
methods, and it is my purpose here to review these efforts and evalua-
t their accomplishments.

If we omit casual clinical observation and limit ourselves to planned
experiments in psychopathology, we can trace the beginning of the
application of biometric methods to the last two decades of the 19th
century. Kraepelin\textsuperscript{15} began his experiments in the production of
temporarily disordered mental states in normals with drugs in the
1880's, and Krafft-Ebing\textsuperscript{17} demonstrated in 1897 the immunity which
general paretics exhibit to syphilis, proving that syphilis was the
cause of general paresis even before spirochetes were found in the
brain tissues of general paretics.

Perhaps one of the greatest triumphs of the biometric approach in
psychopathology was the development of the intelligence test. Here,
for the first time, the subjective impressions regarding intelligence
that each clinician had to form were replaced by a precise instrument
which could be used to classify individuals as well as to test hy-
potheses of multifactorial causation in genetics, or of early maternal
derivation in environmental studies. The high degree of success
attained by the intelligence test has raised hopes of accomplishing
similar results in the field of personality measurement. Unfortunately,
progress in this field has not been as rapid. The criteria for the evalua-
tion of intelligence in terms of school success, vocational success, etc.,
find no clear parallel in the field of personality. It is apparently easier
to determine successful adjustment in school in terms of educational
achievement and its correlate—intelligence—than it is to determine
successful adjustment in life in terms of personality characteristics.
Thus, while intelligence tests are of considerable help in the diagnosis
of feeblemindedness, they offer relatively little help in the diagnosis
of the character disorders, neuroses, psychopathic personalities, psy-
chooses and epilepsy.
Two decades later, an interesting biometric advance was brought about by Henry Cotton's claims for his "Focal Infection Theory" as the etiologic factor in mental disorders. To test this hypothesis Kirby and Kopeloff of the Psychiatric Institute, then at Ward's Island, removed all foci of potential infection (caries teeth, diseased tonsils, infected colons, etc.) in one group of 58 patients and compared the outcome with a matched control group of 62, on whom no operations were performed. No significant difference was observed between the two groups in rate of improvement, but there was a difference in mortality, the treated group showing the higher mortality rate.

Even before the advent of the experimental approach to psychopathologic problems, a considerable amount of routinely collected data on the number and characteristics of mental patients became available. Esquirol the pupil of Pinel was said to be the first to have applied statistics to the field of psychiatry. He tabulated the frequencies of "psychologic" causes in the etiology of mental disorders and found that about 26 per cent of the male patients in the Bicêtre and about 30 per cent of the female patients at the Salpêtrière gave such psychologic factors as disappointment in love, financial worries, and similar factors as the alleged basis for their illness.

There is a vast accumulation of data in the older established hospitals regarding admissions, discharges, deaths and resident population which is only now becoming available to public scrutiny as a result of the current interest in epidemiologic studies in mental disease and in the outcome of therapy. A perusal of the older records can not help but increase one's respect for the sagacious judgments made by the early psychiatrists on the basis of their meager data.

As a result of the surveys of such material by Goldhamer and Marshall it has become possible to draw conclusions regarding trends of mental disease and its outcome during the past 100 years. Although it might be hazardous to compare the data of the 19th century with those of the 20th, the accomplishments of today do not loom so large when such comparisons are made. For example, the incidence of mental disorders has not been markedly reduced during the last 100 years, nor have improvement rates been markedly raised except in a few diseases like general paresis and pellagra with psychosis where the treatment is based on rational therapy.
One of the sources of information regarding the mentally ill of the United States has been provided by the Annual Census of patients in hospitals for mental disease. At first, attempts were made to obtain such information through the decennial census. Beginning with 1840 and in each of the subsequent censuses up to 1890 enumerations of the insane and idiots in and out of hospitals were made. In several censuses the information obtained from enumerators was supplemented by reports from physicians. The oscillations in the population rates based on these data from decade to decade indicate clearly that the enumerations were not complete. With the establishment of the state hospital systems, direct enumeration by questionnaire of the number and movement of patients in the various mental hospitals replaced enumeration at the time of the decennial census. It is unfortunate, however, that the enumeration of patients in mental hospitals never coincides with the decennial census and thus prevents the statisticians from computing rates based on simultaneous counting of the mentally ill and the general population from which they are drawn.

By 1917 the American Psychiatric Association established a statistical system which was adopted by nearly all the states of the Union, but it did not become universally accepted until the Federal Census Bureau, the U. S. Public Health Service, the Veterans Administration, the Army and Navy adopted it. Much of the credit for pioneering in this effort goes to the late Horatio M. Pollock, formerly Director of Mental Hygiene Statistics of the State of New York. More recently, the National Institute of Mental Health created a Division of Biometrics which has initiated a Model Reporting Area of some 11 states equipped with punch card methods and good systems of recording. As more states develop better methods they will be taken into the Model Reporting Area. Meantime, statistics based on these cooperating states will provide answers to the many questions facing administrators, legislators, and others concerned with the problem of mental disease.

With the availability of good data beginning with about 1890 in the state of New York, and with the spread of these systems for collection of data in the other states, it became possible to conduct investigations in the epidemiologic aspects of the mental disorders. Many studies of incidence, prevalence and movement of patient
populations in the state hospitals became possible, and the two states which excelled in these efforts were New York and Massachusetts. As a result, we now have more definite information on age, specific first admission rates to mental hospitals, hospitalization rates, expectancy rates based on life table procedures, improvement rates and mortality rates. The statistical problems of mental disease are being resolved with the introduction of the actuarial methods now in vogue in the enumeration and analysis of data in other diseases. Some of the conclusions which have emerged from such studies will be referred to in subsequent portions of this paper.

Despite the brief history of biometrics in psychopathology, it is already impossible to survey the entire field in one hour, and I shall therefore limit myself to sampling the field, sinking a shaft here and there to indicate the wide variety of biometric procedures now in use and the usefulness of the findings made available by such methods. In order to make this sampling representative of the areas in which biometric methods have been applied, the following classification of these areas will be made: (1) epidemiologic studies (2) genetic and environmental studies (3) evaluation of the outcome of therapy (4) experimental psychopathology and (5) personality and body-type measurement in relation to psychopathology.

In the epidemiologic studies, Malzberg,$^{22}$ following the earlier pattern of his work done with Pollock,$^{27}$ found that when appropriate corrections are made for changes in mortality rates during the last few decades the expectancy of hospitalization for mental disease at birth in 1920, 1930, and 1940 for males is 4.8, 5.9 and 6.6 per cent respectively and for females is 4.4, 4.6, 5.8 per cent respectively. Whether this apparent rise reflects an increase in expectancy in general or only in the old age psychoses, is debatable. The increase in the hospitalization of the aged may reflect mores rather than biology, since such factors as availability of hospital beds, improvement of custodial care and therapy with consequent changes in attitude towards hospitalization for mental illness, and regional-cultural variations in attitude towards the hospitalization of old folks may play an important role in determining the rate of first admissions for the aged. The tremendous increase in first admission rates in this country for the population aged 50 and over is not found according to Landis and Page$^{18}$ in Norway. Instead, there is a decline after age 40, ap-
parently because of governmental aid for the aged to their families. Even in our country the attitude towards hospitalization of the aged shows vast regional differences. An analysis of the 1933 data for patients in hospitals for mental disease by Zubin and Scholz\(^2\) indicates that first admission for the diseases of the senium (senile dementia and psychoses with cerebral arteriosclerosis) show nearly twice as much variation in first admission rates from region to region as do diseases of psychogenic origin (schizophrenia and manic depressive psychosis) and the other grouping of the mental disorders.

By regarding mental disorders from the epidemiologic point of view, it becomes possible to link up hospital statistics with community characteristics, and the unhospitalized mentally ill can be brought into the picture.\(^3\) Studies of entire communities in an isolated island off the Danish Coast (Bornholm),\(^4\), \(^5\) as well as studies of specific localities in the United States (Williamson County, Tenn.,\(^6\) and Eastern Health District, Baltimore\(^7\)) have yielded the figure of approximately 12 per cent expectancy as a rather constant proportion of a given generation likely to be mentally deviant. About half this number is likely to require institutional care for mental disease or mental defect for a longer or shorter period before death. These studies are not entirely comparable, but the fact that most of them agree within a relatively narrow margin of error, may be taken as some indication of a certain degree of universality in some of the factors underlying mental disorders throughout the world.

In the genetic area, the observations of many clinicians agree that certain mental disorders run in families. Investigation of Huntington's chorea has demonstrated conclusively that it is inherited along mendelian lines as a dominant characteristic. The application of contingency methods in which blood relatives of schizophrenics were compared with the rest of the population for the incidence of schizophrenia by Rüdin and his school, have not always yielded data which could be interpreted along mendelian probability lines. But the increase of schizophrenia with increase in blood relationship to the schizophrenic index case has demonstrated conclusively that there must be a familial factor in the production of this mental disorder. When the very refined twin-method of studying genetic factors was developed, it became quite clear that at least certain nuclear or basic
types of schizophrenia are transmitted in a genetically determined manner. For example, Kallmann\textsuperscript{11} has reported that for dizygotic twins, the degree of concordance with regard to schizophrenia is no greater than for siblings (14 per cent) while for monozygotic twins it jumps to 85 per cent: 90 per cent for twins reared together and 75 per cent for twins reared apart. One unusual conclusion that Kallmann's study leads to is that contrary to the tenets of the environmentalists, not everyone is capable of developing schizophrenia even under the severest stress. Only those who have inherited the predisposition can ever hope to become real schizophrenics.

In the environmental studies the investigations of the importance of maternal deprivation in subsequent development of the child looms large. A recent survey by Bowlby\textsuperscript{3} collected all the relevant studies in this area. Of great interest from the biometric point of view are those of Goldfarb.\textsuperscript{6} He followed up a group of children who had been institutionalized soon after birth with a group who had been raised in foster homes. Unfortunately, no pre-institutionalization records were available. After applying a series of psychologic tests and scales he arrived at the conclusion that the institutionalized children were inferior to their controls in concept formation tests and general intelligence. Furthermore, they exhibited clinical behavior which would more often be diagnosed as character disorder. One would wish for even better controlled studies on this moot point and perhaps the time is now ripe to introduce twin studies into this area.

An older approach to the importance of the environment is that of Faris and Dunham\textsuperscript{4} and their ecologic approach to mental disorders. Their classical findings regarding the tendency of schizophrenics to be hospitalized from the roaming-house areas of large urban centers, and of manic-depressives to be hospitalized from the suburban areas has been given various interpretations in accordance with the biases of the interpreters. It nevertheless presents an important technic in the investigation of mental disorders.

A third area to which biometric methods have been applied are the studies in the evaluation of outcome of therapies. Unfortunately the data in this area suffer from a lack of consistency in definitions and from a lack of adequate control. Nevertheless, a survey of the literature has revealed that the immediate outcome in the treated groups
generally excels that of the control; but this advantage is lost in five-year follow-up studies. The implications of this finding will be discussed further.36

The evaluation of personality changes produced under the various therapies is another important area. Since the clinical judgments of "cured," "improved" and "unimproved" are inexact terms (applicable perhaps to the outcome of acute physical diseases, but hardly applicable to chronic ailments such as most mental disorders present) biometrically-minded psychopathologists have begun to develop scaling devices in the form of rating scales for the evaluation of the pretreatment and posttreatment status of patients. Such scales, couched in rigorously defined terms, often in Basic English, have already yielded a rich harvest of objectively treatable data for evaluating changes coming in the wake of therapy.36

In the field of experimental psychopathology, we shall limit ourselves to human investigations. In this area, one of the most interesting series of biometric applications has been made in studies in which the internal environment of the human being has been altered by such methods as semistarvation, drugs, ECT, Insulin therapy and psychosurgery.

In the semistarvation experiments conducted by the physiologic laboratory of the University of Minnesota4 on volunteers, the influence of semistarvation on such factors as intelligence, psychophysiological functioning and personality was investigated by tests, laboratory technics and interviews. The transient changes in psychologic functioning arising with food deprivation resembled more neurotic than psychotic behavior. Added to the previous studies on experimental vitamin deficiency and on the study of psychoses following in the wake of pellagra, the role of nutritional factors in the production of psychopathologic behavior has been quantitatively established.19

Sometimes the changes produced by a given therapeutic method throw light on some moot question of theoretic value, in addition to the light cast on the efficacy of the therapy. One notable example is the light cast by psychosurgery on the very vital question of brain function. By means of suitable physiologic and psychologic tests and technics, the biometrically oriented investigators of the Columbia-Greystone Project23 and the New York State Brain Project have
demonstrated that the textbook notions of brain function, especially as far as frontal lobes are concerned, are entirely invalid. Far from solving the problem, these investigators have merely removed the underbrush that has grown up on the basis of impressionistic clinical observations, and have again demonstrated the power of biometric methods in aiding both the clinician and the scientist in dealing with such material. Contrary to the traditional belief that the frontal lobes mediate association, learning, abstract behavior, etc., their surgical removal in part or in toto apparently has no effect on these functions. On the positive side, it is likely that the morbid anguish or apprehensive dread of the mental patient and the intractable pain in carcinoma are reduced by removal of frontal lobe tissue. This finding is based on scaling devices prepared to measure certain aspects of morbid anguish, as well as on the more gross clinical observations. Similarly, biometric methods have succeeded in indicating that the shock therapies do not injure memory or learning ability, and indeed, improve these functions as the patient recovers.  

Perhaps the greatest impetus to biometric studies of mental disease has come from Kraepelin. In 1894, in his first article in the Psychologische Arbeiten he indicated that psychologic tests are our final criterion for determining abnormality:

"As soon as our methodology has sufficiently proved itself through experiences with healthy individuals, it would be possible to approach the actual ultimate goal of these efforts—the investigation of the sick personality, especially of the inborn pathologic disposition. In an investigation of many individuals we will always find some who deviate profoundly from the behavior of the vast majority in one or another aspect. If this deviation appears to be damaging to the mental life, and if it reaches a certain degree—which admittedly can only be arbitrarily determined—then we tend to regard it as an illness. Experience teaches us that persons with pathologic traits of this kind are, on the whole, in greater danger of a general mental disturbance than those personalities (natures) whose characteristics are in the middle range. We therefore have first of all to investigate whether it is possible by means of psychologic tests to determine individual deviations, which can not be recognized by ordinary observation. If that succeeds, we would be in the position—through the quantitative
determinations which are at our disposal—to establish the borderline between health and disease much more precisely and more validly than has been possible so far.\textsuperscript{16, p. 96}

Drugs have been used in experimental psychopathology ever since Kraepelin introduced them in the 1880’s for inducing deviant behavior in normals. The therapeutic results obtained by means of drugs in epilepsy and in narco-synthesis need not detain us here, since they are well known, but the recent introduction of cortisone, ACTH, as well as the antihistamines, lysergic acid and the earlier use of mescaline have now attracted the interests of the biometrically-minded research worker. The side effects of the antihistamines have recently been investigated by such methods as critical flicker fusion, reaction time, tapping and focused interview technics.\textsuperscript{30} By utilizing phenobarbital sodium and dexedrine as anchoring points, the side effects of various antihistamines were investigated. One of the major findings has been that performance is often divorced from feeling-tone as revealed in the focused interviews. Furthermore, not all the antihistamines were found to have deleterious side effects. The biometrically most useful finding has been that group statistics are not applicable to such experiments. Instead, sufficient data must be obtained on each individual so that he can be studied as a separate universe, especially since the thresholds for drug effects vary so much from subject to subject. The effects of the other drugs are currently being studied by suitable experimental and biometric methods in both patients and normal subjects.

In the area of personality and body-type studies, various significant biometric advances have been made.

Utilizing Sheldon’s technic for somatotyping patients, it was possible to demonstrate that patients with high athletic components resist the onset of schizophrenia longer than their brothers whose athletic component is lower. A correlation of .47 was found between age of hospitalization and the athletic component.\textsuperscript{4} A similar correlation was found with resistance to deterioration.\textsuperscript{11}

In the biometric evaluation of the depression syndrome, the following studies have been undertaken: 1) studies for defining the concept rigorously; 2) technics for detecting incipient depression; 3) quantification of the degree of depression present; 4) determination of personalities susceptible to depression; 5) provision of methods for studying
depression in the pure state. Since Adolph Meyer's dictum that we
do not know how to define depression still holds true today, we must
resort to some other way of determining its essence than by logical
definition. One solution is to find the common elements that charac-
terize the depressed. T. V. Moore has used the method of factor
analysis for classifying patients in accordance with their traits and
confirmed Kraepelin's nosologic categories of "agitated depressions"
(patients who were sad and anxious) and "retarded depressions"
(physically tired and worn out). Intellectual deficits were not involved
but feelings and emotional behavior were affected. This statistical
confirmation lends a more rigorous framework for nosology than pre-
viously available.

The detection of incipient stages of depression even before they
become clinically manifest is evidenced in cases of "retarded depres-
sion" by gradual slowing of reaction time, accompanied by increased
accuracy, constriction of interests, narrowing of imagination, stere-
otypy and uncertainty. These factors can be observed when the
patient comes for interview, but they can also be detected in persons
before they come to the diagnostician by techniques such as the par-
otid secretory rate, test interviews, Rorschach and other projective
methods. One of the outstanding psychologic traits accompanying
"retarded depression" is the increase in general accuracy that comes
with depression. This is shown by the Bender Visual Motor Gestalt
Test, the F+ (sharpened visual perception) on the Rorschach Test,
the pedantic definition set on the Word Association Test and the
increased attention on the second half of tests of concentration. One
wonders whether this increase in accuracy with depression is a reflec-
tion of the lowering of speed which usually accompanies increased
accuracy even in normals or whether it is due to the increased auto-
criticism which comes with depression or whether those who are by
nature more accurate are the persons more prone to depressions.

Additional weight is attached to this syndrome (decrease in speed
and increase in accuracy) in diagnosing depression, by the observa-
tion of Hetherington that, as patients improve under ECT, their speed
improves while their accuracy declines. Loss of familiarity, or the
jamais vu phenomenon, has been observed to accompany ECT and a
decline in accuracy in performance on the Word Association Test
with removal of depression has also been observed. The degree of
depression present can often be gauged by means of hand-writing analysis, specific behavior rating scales, projective test indicators and the reported rate of fluctuation on ambiguous figures like the Necker cube or staircase illusion.

Pure culture depression unaccompanied by other malignant trends has been observed in persons who are suddenly deprived of their hearing by war injuries or other accidents. The sudden removal of the background noises which give the normal hearing a continuous feeling of being alive brings about sadness and grief and a feeling of the world being dead even in individuals who were otherwise apparently not prone to depression. René Spitz has reported anaclitic depression in infants, occurring in connection with the withdrawal of maternal care in otherwise presumably normal infants. Sutherland and Orbach of The Memorial Hospital found that imminence of surgery for carcinoma produces depressions in patients who are presumably normal. These variously induced depressions should help disentangle the basic from the incidental in the understanding of the depressive syndrome. It is clear that the phenomenon of depression can be subjected to biometric evaluation and such studies have yielded interesting and consistent results.

Thus far we have concerned ourselves primarily with group biometrics, in which the individual case is lost in the background and the group tendencies are our chief concern. To have spent more than half of my allotted time and not once raise the question of the individual case which psychopathology is so basically concerned with is either a feat, or a sleight-of-hand misrepresentation of my topic. I must hurry, therefore, to indicate what biometric methods can accomplish for the individual case.

Full recognition of the importance of biometric methods in the study of the clinical case was afforded by the Biometric Division of the American Statistical Association when it arranged the symposium on Statistics for the Clinician at its annual meeting in Cleveland in 1948. Here an attempt was made to reverse the figure-ground relationship which obtains in group biometrics and make the individual case the center of attention and permit the group to vanish into the background. This transposition of the individual and the group is more than a tour-de-force and may be likened to the transformation in projective geometry of theorems about lines to corresponding theorems
about points and vice versa. Instead of one variable and many individuals, we have one individual and many variables.

The development of scientific measurement as Weaver\textsuperscript{33} points out has grown apace with the greater complexity of scientific problems. When simple problems in which all but two variables (the independent and dependent) could be kept constant were the concern of science, functional mathematical relationships such as the Gas Law, \( PV = RMT \), were sufficient to the task at hand. As science developed, the two variable constraint was relinquished, and multivariable problems in which no constraints except the degrees of freedom made available by the number of observations were the order of the day. This Weaver names “Problem of Disorganized Complexity,” and in the treatment of such data, the mathematical functional rigor of the two variable problems gave way to probability considerations, and statistical methodology came into its own. Finally, it became clear that many of the problems facing scientists, especially in the field of biology, were problems of “organized complexity,” in which the number of variables was still large but not infinite in scope, and furthermore they seemed to be interrelated in an organic whole such as a single organism or a group of identical organisms. This approximates closely to the study of the individual case, and methods for such investigations are now being developed.

Applications of these newer technics have been made to two types of studies—pre- and post-therapy studies and pre- and post-drug studies. An examination of such clinical data soon reveals the fact that when many cases are considered as a group, the degree of homogeneity with regard to specific variables under measurement is very low, and heterogeneity rather than homogeneity is the outstanding characteristic of the group. Why such heterogeneity should invariably be found even in groups of patients selected according to certain sampling principles has always been a puzzle. It may be that our groups are in reality very heterogeneous because our classification systems are so poor, or, that intra-individual variability is one of the transcending characteristics of the mentally ill, as Jellinek\textsuperscript{10} has suggested, and his intra-individual variability results in group heterogeneity. Whatever the cause may be, many a biometric investigation in psychopathology has foundered on the rocks of intra-individual variability. There are two possible solutions: 1) introduce a sufficient number of
repeated measures to capture and assay the intra-individual variability exhibited by the patient, and investigate variability itself as another variable, or 2) give up the idea of group statistics and study each patient as a universe unto himself. Here again repeated measurements will be needed. If the influence of a given therapy or drug on a given psychologic or physiologic function is under investigation, a sufficient number of measures must be taken during the pretreatment, treatment and post-treatment periods to enable the use of statistical methods for determining whether the difference between the means for a single individual is significant. Such procedures invariably raise the important considerations of the influence of repeated practice on the test in question and other intra-individual problems that need solution. Thus far, however, no superior method has been advocated when such heterogeneous data are under consideration. Examples of such studies are afforded by the psychosurgery investigations conducted by the Columbia-Greystone Associates and the New York State Brain Project. A similar analysis was conducted on the side-effects of antihistamines. Here an additional source of heterogeneity arises insofar as the thresholds for drug effects vary from person to person. By studying each subject separately it becomes possible to distinguish between individuals for whom the drug dosage were sufficient to elicit a response, and those individuals whose thresholds were too high for the dosage in question. Interestingly enough—though the group analysis revealed no significant difference between drug and placebo—the individual analyses could pick out those who showed drug effects from those who did not.

We may now turn our attention to recent developments and future trends in the growing application of biometrics to the field of psychopathology.

One of the crying needs in the current scene is a method for evaluating the outcome of the various therapies that are now competing for supremacy in the treatment of the mentally ill. Unfortunately, the field of follow-up studies is still in its infancy, and no ready method are available for evaluating the outcome of the various therapies. This has given rise to considerable controversy in the literature. For example, in follow-up studies of 5 years or more, the groups treated with shock therapy do not invariably show an advantage over comparable untreated cases. The immediate outcome, however, is usually
superior in those treated. This advantage in immediate outcome is not to be disregarded since it represents a curtailment in human anguish and a saving in hospital expenditures. Furthermore, such data as are available seem to show a lower mortality rate for the treated patients. It is quite likely that deaths from inanition in patients who refuse food, and deaths from exhaustion or by suicide in agitated individuals are not as frequent now as they were formerly, since after several shock treatments the negativistic or excited patient becomes manageable and even gains weight. But whether shock therapy invariably improves the outcome in cases of this type is still debatable. Unfortunately, prolongation of life is not regarded as highly in psychopathology as it is in other fields, and, consequently, shock therapies have not been given as much credit for this achievement as they might.

Several technical problems must be faced in these long follow-up studies. Incidental factors like, “lost to the follow-up” or “death from other causes than the disease in question,” enter to obscure the picture. Recently, Neyman has proposed his method of “competing risks” for evaluating outcome of treatment when incidental factors are partialed out or kept constant. An application of this technic to the evaluation of the immediate outcome of shock therapies in the Royal Edinburgh Hospital on 1000 cases of depression has yielded the unexpected result that no advantage accompanied the therapy even in short term follow-up. Whether certain selective factors were at work in this study, since it runs contrary to the reported trend in American experience, remains to be investigated.

The fact that there is no advantage for the various treatments in five year follow-studies gives the biometrician good cause to ponder. This finding holds true not only of the shock therapies, but apparently of psychosurgery, psychotherapy, as well as psychoanalysis, though the data for these therapies are not always as adequate as they might be. One may conclude that present therapies—irrationally based as they are—simply hasten the improvement of those who would improve anyhow. This conclusion, though not contradicted by any data, runs contrary to the fact that there seems to be a growing series of studies which indicate that certain characteristics of the patient can be used to predict outcome. Perhaps, if we developed actuarial tables for predicting outcome for a given therapy from the
pattern of prognostic indicators present in the patient, we might be able to select the specific therapy which is most suited to the patient in question. Under such conditions we may be able to achieve improvement rates higher than those observed in untreated control groups even in 5 year follow-up studies. An example of such prognostic efficacy is afforded by the data in the recent Columbia-Greystone Study.\(^8\)

While the comparison between the operated group and the nonoperated group yielded a Chi Square which was too low to be significant, it was possible to predict, retrospectively by means of psychologic test performance, which patients would get well and which would remain in the hospital. The patients who did well on the tests, are still in the hospital. The patients who did poorly on the tests are now home. It will take considerable research to discover why the chronic patient show a negative correlation between test performance and outcome. At present, the best guess we have (based on several studies) is that the chronic patients whose perceptual capacities exceed their conceptual capacities have a good prognosis with or without specific therapy, while those whose perceptual capacities fall below their conceptual capacities have a poor prognosis. Since perceptual deficiency is usually found in organic cases, perhaps those schizophrenics whose perceptual capacity is impaired give evidence, thereby, of an organic involvement which is generally not reversible, while those whose perceptual capacities are relatively unimpaired give no evidence of organic involvement and have a better prognosis. If one identifies those whose perceptual capacities exceed the conceptual with Jung's extroverted type and, conversely, those whose perceptual capacities fall below the conceptual with the introvert type, it may be concluded that the chronic schizophrenic with extrovert tendencies has a much more hopeful outlook under present day therapies than the chronic schizophrenic with introvert tendencies.

The needs of the future development of biometric psychopathology center about the development of methods for obtaining homogeneous groups of patients to whom suitable therapies can be applied. The problem of obtaining homogeneous groups involves the improvement of diagnostic methods and the development of appropriate parameters. Until such homogeneous groupings are evolved, our therapeutic progress will have to be slow. Scaling methods for evaluating patient cha
characteristics may be of help in the development of more homogeneous classifications.

A second need is the development of technics for studying individual similarities between patients. We have placed so much stress on the study of individual differences that the study of individual similarities has lagged far behind. Yet, the clinician is often more concerned with such questions as, "Whom does this patient resemble?" or "What previous patient does he remind me of?"

A great difficulty facing all therapeutic investigations is the question of criteria of improvement. Some headway has been made with the use of scales, but much more progress will have to come before the problem of criteria is solved. The goals of therapy vary with each disease, and the problem of what the optimal goals are for therapy in each disorder has never been specified. For acute physical illnesses and perhaps, for early acute recoverable mental illnesses, the goal is a return to the premorbid level. For chronic illnesses (physical or mental) a return to the premorbid level of functioning rarely occurs. Furthermore, if the illness lasts several years the ageing process itself brings about changes in ultimate adjustment which have to be considered. Sometimes the therapeutic process itself may cause some defects. Each of these factors must be considered in any evaluation of outcome and in the establishment of criteria for such evaluation.

Perhaps the greatest stumbling block in the path of progress is the scientist's rightful stress of the need for controls. By the time a hospital has mobilized its resources for a scientific investigation of a given problem, it has usually exhausted its available facilities. To add to its load the essential control group—which so often appears to the clinician as a useless burden—sometimes spells failure for the entire project. In order to ease the load on a given hospital, I would like to propose that standard control groups of specific homogeneous characteristics be established, and that the subsequent course of the illness in these standard control groups—without benefit of specific therapies—be checked. Such groups would provide the base line for evaluating therapeutic efforts. If, every time a new therapy is suggested, a hospital would select a suitable group of patients similar to one of the control series, the outcome of the therapy in question could be very readily evaluated through a comparison of the treated group with the standard control group. Furthermore, if prognostic
tests are developed in conjunction with such standard control groups, an actuarial table could be developed for each prognostic pattern, giving the probability of success for the various therapies.

Such standard control groups could be developed in hospitals where insufficient staffs are not able to provide the most advanced therapies for every patient. If sufficient funds are provided for raising the level of patient care to a good custodial level, with ample types of recreation and "total push" facilities, the subsequent history of the patients in this standard control group would provide a further basis for evaluation. Such standard control groups would, of course, have to be under the continued scrutiny of consulting psychiatrists, psychologists, social workers and—last but not least—biometricians, if a proper evaluation of the outcome is to be made.¹⁰

Summary

A survey of biometric psychopathology has revealed that despite the qualitative nature of much contemporary data, a beginning has been made in quantification and measurement. Within the last three years, systematic collections of data on incidence and prevalence of mental disorders have been provided which have yielded actuarial estimates of expectancy of hospitalization. Epidemiologic studies in specific areas, both in this country and abroad, indicate that some 1\% per cent of the current generation may expect some type of mental deviation, and about one half of this number may expect hospitalization for mental disorder or mental defect for a longer or a shorter period before death. The application of ecologic methods and genetic epidemiologic methods may fill the missing link between hospital and community statistics. Genetic and environmental factors have been weighed by biometric methods and the goal of etiologic understanding of mental disorders has been brought considerably closer. The role of constitutional factors has been placed on a firmer footing and the relevance of body type to resistance to schizophrenia has been investigated. The biometric tools of factor analysis, developed by psychologists, have been successfully applied to the problem of methodology.

The importance of biometric procedures for follow-up studies has been pointed out. Especially important are the competing risk techniques which were developed by Jerzy Neyman. The special role of clinic
statistics with its stress on statistics of the individual case has been brought to the fore. Much more biometric ingenuity is required to transform group- to individual-centered methods.

The greatest need of the day is the provision of methods for selecting homogeneous groups of patients for evaluation of therapy and for the development of standard control groups which can serve as baselines for the evaluation of new therapies. When such guide posts are developed, biometric psychopathology will be able to take a hand in determining the efficacy of the various treatments now in vogue and replace the subjective judgments of physician, patient and family by objective quantitative measures.

Perhaps the best way to summarize would be to quote Kraepelin's introduction to his *Psychologische Arbeiten*:

It is high time . . . that in psychologic questions, the serious and conscientious investigation of specific problems replace the clever contentions and profound inventions. With that which is undemonstrable, or irrefutable, we can go no further. We need facts, not theories. To be sure, no science can do without integrative points of view and tentative assumptions; but we must never forget that they have no independent inherent value. They are merely means to an end; their justification can be found only in the fact that they lead to definite questions and thereby to new investigations. Such questions have been, I believe, raised in sufficient numbers here. We now ought to proceed to answer them not at the green table (or arm chair) but in the laboratory; not with brilliant suggestions but with observation and measurement.

Unfortunately, the target set by Kraepelin has not attracted much attention until recently. Now, both in this country and in England biometric surveys of patient populations, with psychologic, physiologic and biochemical technics are underway with the view of finding the parameters that differentiate normality from abnormality. These studies may well prove to be the foundation on which the early recognition, diagnosis, prognosis and final conquest of the mental disorders will rest.

**References**


Patients in Mental Institutions, Department of Commerce, Bureau of the Census, Washington, D.C., 1936-1946.


41. ——: Unpublished data.