Chapter 12

A Biometric Approach to Diagnosis and Prognosis

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The introduction of biometric considerations and prognosis into a discussion of psychologic testing techniques in diagnosis requires an explanation. Biometrics is the science that deals with the measurement of living organisms, including man. The Biometrics Research staff of the Department of Mental Hygiene of the State of New York has as its mandate the provision of objective measures for assessing the behavior of mental patients with respect to their premorbid status, morbid status, course of illness and outcome, with the view of improving diagnosis, prognosis and treatment. To accomplish this end, the Biometrics Research staff has had to study the entire spectrum of behavior, using the methods of the social sciences, psychology, psychiatry and the biological sciences. From the social sciences, anthropologists, sociologists and social psychologists have contributed their skills. From psychology, specialists in the physiological, sensory, perceptual, psychomotor, conceptual and clinical areas have made contributions. Clinical as well as research psychiatrists have joined in this work and collaboration has been developed with biochemistry, pharmacology, neuropathology and neurology.

Since no single person can encompass this broad spectrum of knowledge, our staff has perforce become interdisciplinary. In many instances we have engaged in basic science to develop insights, tools and techniques, and have investigated the general population in order to develop norms.

Biometrics Research was set up because of the need for providing hard facts about mental patients which would serve as gauges of the current and contemplated improvements introduced into the New York State Mental Hospital system. It was felt that unless such hard core facts could be presented, considerable resistance would be encountered in the securing of funds for instituting improvements in the care of the patients.

The reason for dealing with prognosis in a consideration of diagnosis also requires some explanation. It had been clear for some time that current clinical diagnosis had reached a plateau; that further progress could not be achieved by the standard psychiatric or psychological approaches. The results that had been achieved from Kraepelin's days onward, notable though they were, depended upon subjective, intuitive, objectively unspecifiable factors which defied further analysis.
Moreover, a revolution had occurred in our midst, which seemed, at first, to diminish the value of diagnosis. Whereas in former years only about one-third of the patients were considered improved enough to be released, now fully two-thirds or more found their way back to the community, for reasons still unknown. This wholesale return under uniform treatment seemed to render diagnosis futile. The revolution which brought this about had two sources: improvement in management and break-throughs in research. Both of these sets of factors introduced a therapeutic optimism which swept away in its wake such longstanding obstacles to progress as old-fashioned nosological systems, closed wards and cautious release policies. It brought with it a doubling of release rates, an increase in admissions, a reduction in the resident population, invasion of psychopathology by social science and other disciplines and an increase in tolerance for the patient in the community.

The revolution brought with it, also, as most revolutions do, certain hazards. On the one hand the very need for the existence of mental hospitals began to be questioned; and on the other hand, the wholesale release of patients into the community began to be regarded with a critical eye. Several decades ago, the return of former schizophrenic mothers to care for their children, or of former schizophrenics to their classroom duties, would have been regarded with horror. Now, there are twice as many ex-patients as there were 15 years ago caring for the young, teaching school, practicing psychiatry, psychology, and social work, serving as executives, lawyers, etc. There is a grave hazard involved in such trends unless careful prognostic studies are undertaken to determine who is likely to succeed after release to the community.

The current rebirth of interest in prognosis can be dated from the disclosure that the most careful evaluation of all therapies on 5-year follow-up indicates that none of the therapies do better than spontaneous improvement as gauged by the pre-1930 type of custodial care. Whether drug therapies will fare any better remains to be seen.

This finding presents a challenge to therapists even when immediate results look promising. Perhaps this average result comes about because of a random assignment of patients to the specific therapies. If we could select patients prior to treatment, who are most likely to respond to a specified therapy, we might win against the heavy odds that spontaneous improvement lays against our results. Thus, diagnosis is necessary in the choice of therapy, and prognosis necessary in selection of patients for release.

Diagnosis appears to have gone as far as it can go and only prognosis can come to the rescue. Perhaps the reasons why science has failed to provide the psychiatrist with better diagnostic tools should be sought in the following factors: (1) focus on a limited spectrum of behavior—the conceptual area, as is the case with intelligence and projective tests, (2) concentration on the morbid status of the patient to the neglect of his premorbid characteristics; and (3) failure to provide objective criteria for evaluating outcome through follow-up studies. A fourth difficulty arises from the fact that too much stress has probably been placed on individual differences in our psychological investigations and not enough on individual similarities. Clinical classification is in reality a search for similarities. The good clinician asks himself first, "Of whom does this
case remind me? Whom does he resemble? Since most of our research tools and statistical methods focus on finding individual or group differences and do not provide for integration of similarities, it is understandable why tests have not helped very much.

In order to break through the current impasse, we must return to the clinical view of studying each patient longitudinally to seek out his premorbid characteristics, his morbid characteristics and the course of his illness. We must then use these data in retrospective or prospective studies of outcome. In a sense, this is a return to Kraepelin's method of relating the natural history of the illness to outcome.

A review of the literature has identified some 800 prognostic studies in schizophrenia alone. It is interesting to note that 80 per cent of the prognostic traits found in these studies have retained their prognostic potential since 1900. It was good for outcome of schizophrenia in 1900 to have a sudden onset, it is still good today. Flatness of affect predicted poor outcome in 1900; it still does so today. During the last 50 years therapies have come and gone, but the prognostic value of the patient's personality has remained unchanged. Apparently, what the patient brings to the therapy—his personality—seems far more important than the therapy itself.

Time does not permit a description of each of the 150 traits, but the next two tables will serve as examples.

In Table 1 the results are shown of the analysis of 740 studies, each dealing with the relation between type of onset and outcome. Regardless of therapy, 708 of these 740 studies found 'sudden onset' more favorable
than ‘insidious onset.’ It is apparent that knowledge of type of onset is important for prognosis, but the data required for making a clinical judgment regarding onset are not readily available. For this reason, an attempt is being made to develop objective techniques for determining type of onset.

Table 1. Prognosis by Type of Onset of Illness in Relation to Type of Therapy

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<th>NON-SPECIFIC</th>
<th>E C T</th>
<th>INSULIN</th>
<th>MET-RAZOL</th>
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I. DIRECT MEASURE
A. CLINICAL EVALUATION OF ONSET
1. Sudden vs. gradual
   112 0 25 0 29 0 5 0 6 0 177 0 177

II. INDIRECT INDICES
A. PREPSYCHOTIC PERSONALITY
1. Normal vs. abnormal
   2 0
2. Introverted or cyclothymic vs. extroverted, schizoid or shut-in
   70 0 8 9 0 10 0 2 0 91 0 8 99
B. PSYCHOSOCIAL DEVELOPMENT
1. Presence vs. absence of heterosexual contacts or interests
   2 1 1 0 2 0 1 0 6 1 7 1
2. Married vs. single
   6 1 1 0
C. PREPSYCHOTIC SOCIAL AND WORK HISTORY
1. Good vs. poor social history
   43 0 2 11 0 19 0 2 0 13 0 88 0 2 90
2. Good vs. poor work history
   2 0
D. INTEREST IN ENVIRONMENT PRIOR TO HOSPITALIZATION
1. Sudden vs. gradual loss
   1 0 1 0
2. Retention vs. loss of interest
   7 0
E. PRECIPITATING FACTORS
1. Presence vs. absence
   71 0 4 0 8 0 6 0 89 0 89
F. DURATION OF ILLNESS PRIOR TO HOSPITALIZATION
1. Less than two years vs. more than two years
   84 6 1 36 1 88 2 14 2 15 8 237 19 1 257

Total
   400 8 11 88 1 156 2 21 2 45 8 708 21 11 740


Table 2. Prognosis by Type of Affect Displayed During Hospitalization in Relation to Therapy

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<tr>
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<th>NON-SPECIFIC</th>
<th>E C T</th>
<th>INSULIN</th>
<th>MET-RAZOL</th>
<th>LOR-OTOMY</th>
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I. DIRECT CLINICAL EVALUATION
A. Good, preserved affect vs. dull blunted affect or apathy
   43 0 5 0 8 0 1 0 7 0 64 0 64
B. Other indications of affect
   15 0 4 0 5 0 2 0 18 0 44 0 44
C. Appropriate vs. inappropriate affect
   9 1 0 1 0 11 2 13

TOTAL
   67 1 9 0 13 1 3 0 27 0 119 2 121

II. INDIRECT INDICES OF AFFECT
A. Presence vs. absence of guilt feelings
   9 0 2 0 1 0 3 0 15 0 15
B. Manic depressive symptoms
   19 0
C. Good vs. poor rapport with examiner
   6 0

TOTAL
   34 0 2 0 1 0 3 0 40 0 40

TOTAL
   101 1 11 0 13 1 4 0 30 0 159 2 161

Table 2 shows the data for type of affect for 159 studies. All of these agreed in the conclusion that the presence of overtly discernible affect, regardless of its quality or direction, usually led to good outcome. Since judgments regarding type of affect are often difficult to obtain clinically and, when obtained, do not possess a high degree of reliability, attempts are being made to provide an objective indicator for affect also.

A detailed analysis of these studies has been presented elsewhere. Here, it will be sufficient to indicate how we provided objective indicators for two common predictors of outcome—type of onset and type of affect.

In order to obtain objective measures of type of affect, a specially developed reinforcement interview has been used. The interview is divided into three portions of 10 minutes each, a control period, a conditioning period and an extinction period. During the control period, or operant level, the interview is conducted in a manner similar to that of taking an anamnesis. During the conditioning period, the interviewer reinforces the patient by saying "Yes," or "I see," or "mm-hm," every time he emits a statement of self-referred affect. In the extinction period, reinforcement is withheld as in the first ten minutes. Tape-recorded interviews of this type have been analyzed for number of self-referred affect statements in each of the three periods. The results, shown in Figure 2, indicate that schizophrenic patients differ from normals in the extinction period, but not in the control, or operant, period, nor in the conditioning period.

In other words, schizophrenics verbalize as much self-referred affect as do normals in free discourse and they increase the number of affect statements under reinforcement at a rate no different from normals; but when reinforcement is withdrawn, the patients show a more rapid decrease in the rate of self-referred affective utterances than the normals do. When the patients who improved at the end of 6 months were contrasted with those who failed to improve, it was found that those who showed an increase in self-referred affect statements during conditioning were mostly in the improved group.

Why those who increase their affective statements during the conditioning period tend to improve clinically remains an interesting question. It is possible that this very capacity to respond to conditioning stimuli may be the basis for their eventual clinical improvement. On the other hand, it is also possible that patients who show a responsiveness to verbal conditioning may be regarded as more likely to succeed in the community than those who show no responsiveness to such conditioning, regardless of other considerations. Only future research can answer this question.

As for type of onset, a careful examination of the literature has indicated that at the present time no systematic procedures for determining type of onset are available. In order to provide an objective determination of type of onset, a survey was made of the kind of evidence available from the premorbid period which might throw light on onset. After a review of school records, summer jobs, friendship patterns, heterosexual adjustment, marital status, and vocational adjustment, it was decided to select adolescent friendship patterns for investigation.
Fig. 2. Individual cumulative affect response curves for two pairs of matched schizophrenics and normals. The top pair shows two subjects with high operant levels, while the bottom pair shows two subjects with low operant levels.


This effort has paid off handsomely. The adolescent friendship patterns found in those who later developed chronic schizophrenia were quite different both from the patterns in those who suffered only short episodes, and from normals.

Although the data have not been analyzed in full, the following impressions were obtained regarding the adolescent relationships of schizophrenics. The subjects were divided into three groups for the analysis of these data. First episode cases were those who were about to be released after a first hospitalization of 6 months; relapsing cases had a history of several hospitalizations; and chronics had been hospitalized continuously for over 3 years. Chronics had, during their adolescence, less continuous interaction with their peers and longer periods of isolation. When they lost friends, they took a longer time to replace them with new ones. They tended to play a more submissive role in relationships—such as being the listener or always doing what the other fellow suggested; chronics tended, more often than first episode cases, to turn to younger or older companions, after reaching age 15, or to very peripheral contacts with peers. They had more trouble in engaging in more than one activity. For example, if they were studying hard they didn’t have time for friends. When they had a girl friend they didn’t have a boy friend, and when they had a job they could not have any friends. This was also true of most chronics whose relationships were
more than peripheral. Chronics more often complained that the relationships got to be too much for them. Chronics were less successful in all spheres of sexual activity: they had fewer dates, worried about impotence, had more bizarre notions about sex, and found sex less interesting than the first episode cases. Chronics were more often taken care of by their friends, e.g., treated to a soda or to the theater. Chronics and relapsing cases also appeared more exclusively involved with one person. Chronics more often claimed to prefer being by themselves. They left school sooner than first episode cases and had a much more sporadic employment history, starting employment about one year later. Chronics more often took long walks by themselves, and, interestingly enough, were mostly employed in delivery and messenger services. First episode cases dated more than chronics and were even more concerned about impotence. They engaged in more group activities, were more successful at making friends, and had shorter periods of isolation. They often stated that they actively withdrew from relationships with their friends as a consequence of their failures to adjust to them. First episode cases had more friends they felt close to, and tended to have more complex relationships with their peers.

It should be noted, however, that friendship patterns differ from one socio-economic status to another. For example, the lower socio-economic adolescents do not seem to have the personal confidante type of relationship. Instead, the gang serves as their focus of friendship, and although they have pals, these pals have close contact only as group members and are easily substituted for one another.

In order to obtain an evaluation of the morbid status of the patient, a new type of analysis had to be made of the patterns of psychological responses that characterize him. An earlier review of the usefulness of psychological tests in prognosis made in our laboratory had failed to find any consistently reported prognostic value in the tests currently in use for diagnosis. A new approach was required. By classifying the categories of behavior, or test-response, into physiological, sensory, perceptual, psychomotor and conceptual, and the methods of eliciting these responses into idling state (no change in stimulation), energy stimuli, and signal stimuli, we obtain Table 3.

It becomes quite clear that most clinical psychological tests belong in the subcategory of conceptual responses elicited by symbol stimuli, while the other subcategories in this table go unstudied. To get a full understanding of the patient's behavior, the pattern of his responses across the entire table must be investigated. We have provided techniques for sampling the behavior indicated in this Mendeléyev-like table of psychological experimentation. At the physiological level we are studying pupillographic responses to light; at the psychomotor level, reaction time to cross-modal stimulation; at the conceptual level we are using the metalog test. Each of these techniques provides a reliable, objective score of a patient's behavior. The prognostic value of these scores is now under investigation.

As for the course of illness, special inventories have been developed for capturing the non-spectacular routine behavior of the patient on the ward, in the work shop, in the interview, etc. These objective records
Table 3. Examples of Measureable Activities as Functions of Stimulus Variables

<table>
<thead>
<tr>
<th>LEVEL OF OBSERVED BEHAVIOR</th>
<th>IDLING STATE</th>
<th>ENERGY VARIABLES</th>
<th>STIMULUS VARIABLES</th>
<th>SIGNAL VARIABLES</th>
<th>SYMBOLS</th>
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<td>FUNCTION</td>
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<td>Inversion of</td>
<td>Aircraft forms</td>
<td>Practical</td>
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<td>gravitational</td>
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<td>Psychomotor</td>
<td>Spontaneous</td>
<td>Painful</td>
<td>Electroshock</td>
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<td>movement</td>
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<td>Perceptual</td>
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<td>White noise</td>
<td>Orientation to</td>
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<td>Photic</td>
<td>Bell ringing</td>
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<td>EEG; basal</td>
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<td>rate of</td>
<td>driving</td>
<td>in Pavlovian</td>
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<td>PGR</td>
<td>concentration</td>
<td>respiration</td>
<td>Change in</td>
<td>conditioning</td>
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of overt behavior provide a basis for judging progress during the course of illness. Similar inventories have been developed for recording pertinent data on follow-up to provide an objective criterion of outcome.

To deal with such a multiplicity of scores, some integrative method had to be developed. Ordinarily, factor analysis is utilized for reducing a multiplicity of scores to a few underlying dimensions into which the original scores can be combined linearly. It is doubtful, however, whether mental patients, even when limited to the schizophrenic group, constitute a sufficiently homogeneous population for factor analysis to be legitimately applied. Furthermore, the linearity of the relationship between variables demanded by factor analysis may not hold true. Consequently, it was decided to find the natural lines of cleavage in our population, and separate the naturally occurring subgroups on the basis of the patterning in their multiple test scores, before proceeding with the analysis of the data.\(^8^\)\(^-^1^3^\) More recently, we have succeeded in developing a simpler approach by considering the pairs of profiles obtained, by matching each individual in turn with every other individual. The sum of the squares of the distances for each test (expressed in standard scores) between the profiles within each pair can be resolved into measures of difference in level, and discrepancy in shape. These two measures can be used to classify the individuals into homogeneous subgroups.

The discussion has ranged beyond the confines of our topic—the psychologic testing techniques in diagnosis—because the constraints of this topic are too confining. Present day psychological testing of patients did not spring into existence full-grown. It began with Wundt’s influence on Kraepelin,\(^3^\) developed independently during the first decade of this century, into intelligence testing, spread into the personality area with the help of personality inventories during and after World War I, was enriched by sorting tests during the inter-bellum years, and blossomed forth into projective techniques during World War II. Since then, rating scales and behavior inventories seem to have taken over. Must we wait for another World War to take the next step? Our proposal is to extend psychological techniques into the evaluation of the premorbid status, fortify the evaluation of the morbid status by means of the new more precise techniques in the physiological, sensory, perceptual, psychomotor and conceptual areas, develop behavior inventories to be used by nurses, attendants, social workers, psychiatrists and psychologists for documenting the course of the illness (since tests are not suitable for this purpose), and provide criteria for the evaluation of outcome. This is the mandate facing clinical, social and experimental psychology today, and it is to be hoped earnestly that we shall live up to its demands.

But, what is wrong with current psychological techniques? The current focus on conceptual responses, elicited by symbol stimuli, provides too narrow a base. Furthermore, the tools which seemed promising at first, like the Rorschach and TAT, have failed to live up to their promise, except perhaps in the hands of a few gifted individuals whose clinical skill is probably independent of their tool. Bringing broader coverage and greater objectivity into diagnostic and prognostic testing is a must, if clinical psychology is not to go the way of phrenology or other fads.

To summarize, diagnostic procedures must be shaken loose from their
present stagnant state if we are to make useful classifications of the patients who pass through the revolving doors of our mental hospitals, and other facilities, in such volume. To prevent wholesale release of patients from doing more harm than good, prognostic procedures must be developed for predicting outcome for each patient under the various possible therapies. We have pointed to systematic ways of making such prognoses, of developing new tools to improve prognostic power, and of improving present day diagnosis by providing objective criteria for classification.

REFERENCES