A STUDY OF THE PERFORMANCE OF MULTIPLE SCLEROSIS PATIENTS ON THE WECHSLER-BELLEVUE

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INTRODUCTION

Ever since neuropathology has recognized multiple sclerosis as a disease sui generis, investigations have been carried out on its etiology, prognosis and treatment, predominantly in the field of medicine. Unfortunately, since multiple sclerosis has no one infallible sign, its diagnosis in the early stages presents a very real problem.

While physiological and mechanistic approaches have been unrewarded[1] in this particular field of neurology, p s y c h o d i a g n o s i s has caught the interest of investigators, as a possible complement to their procedures. Since Gilliland's first attempt[2] at differential diagnosis with the Wechsler-Bellevue, many investigators have experimented on various cases of mental disorder and of brain damage. Among them, only one team could be found to have applied such a testing to the multiple sclerosis patients.

In our investigation a group of sixteen patients diagnosed as multiple sclerotics have been submitted to the Wechsler-Bellevue Scale, Form I. Quantitative results

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1 W.C. Diers, and C.C. Brown, Psychometric Patterns Associated With Multiple Sclerosis; Wechsler-Bellevue Patterns, in Archives of Neurology and Psychiatry, Vol. 63, No. 5, issue of May 1950, p. 760.

2 D. Rapaport, Diagnostic Psychological Testing, Chicago, Yearbook Publishers, 1945, Vol. I, p. 552.

were analyzed with a view to discovering the mental activity of the patients by the study of psychometric patterns, by the measurement of mental deterioration, and by comparison of patterns with those of the "organics".

The first major part of this study is concerned with the nature of the problem. Some of the points treated in the first chapter are the importance, the aim and the problem with its three hypotheses. An historical survey of the literature will bring all this out for consideration.

The experimental design of the investigation will be described in Chapter II. The description of the population and the general procedures will be followed by a description of the methods used in studying each of the three hypotheses.

Chapters III, IV, and V will present the work done to check the validity of the hypotheses. In these chapters the results will be presented, analyzed and evaluated.

Lastly, the conclusions will be summarized and suggestions for further researches will be made.

CHAPTER I

PRESENTATION OF THE PROBLEM

In this chapter a definition of the disease multiple sclerosis will be given and the importance of psychological examination will be discussed. Psychological studies in the literature will be covered. Then the statement of the problem will be exposed in three hypotheses.

1. Definition of multiple sclerosis.

The present study considers multiple sclerosis as a disease entity. The term will be used with the meaning assigned to it in the following medical definition:

> A disease of unknown aetiology characterized pathologically by the widespread occurrence in the nervous system of patches of demyelination followed by gliosis. In most cases the early manifestations of the disease are followed by conspicuous improvement, so that remissions and relapses are a striking feature of the disorder, the course of which may thus be prolonged for many years. The early symptoms are often those of focal lesions of the nervous system, while the later clinical picture is one of progressive dissemination tending to produce the classical features of nystagmus, dysarthris, intention tremor, and ataxic paraplegia[1].

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1 Russell W. Brain, Diseases of the Nervous System, London, Oxford University Press, second edition, 1940, p. 489.

2. Importance of psychological studies.

Because of the unknown aetiology mentioned above, which characterizes in part this baffling disease, its diagnosis in the early cases presents a challenging problem. As yet, the field of medicine has no absolute method to diagnose this neurological disease at its onset.

> The spinal fluid in multiple sclerosis may show a slight lymphocytosis, 10 cells, and a "paretic" gold curve. The pressure and globulin content are normal, the Wasserman reactions are obviously negative. The findings, in general, are not pathognomonic[2].

The chronic patients in general, display a numerous variety of symptoms both physical and emotional in nature. When some of the sclerotic patches impair the normal conduction of impulses of some of the nerve pathways the expected normal activity of the individual is at a loss. If for example, at the onset of the disease one sclerotic lesion is responsible for blurred vision there would be very little chance to diagnose the individual's condition as multiple sclerosis.

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2 I. Wechsler, A Textbook of Clinical Neurology, Philadelphia, W.B. Saunders Co., 1951, p. 562.

> Ordinarily, the diagnosis cannot be made unless there is evidence of more than one lesion or unless there are confirmatory findings in the spinal fluid, but characteristic symptoms of acute transverse myelitis, diplopia or blurred vision or weakness or numbness of one extremity, if transient, create a presumption for the diagnosis[3].

In an attempt to add to the reliability of the diagnosis based on physiological and neurological signs, investigators have recently begun significant experimental researches on the nature and the extent of changes in mental functioning brought about by this crippling disease. More studies are needed and Canter states: "(. . .), at present there still remains a dearth of psychological investigations in this neglected field of study[4]".

In attempting to obtain diagnostic patterns with his tests, the psychologist simply hopes to add to what medical science knows about the disease. While remaining in his field of study, it may be possible for the psychometrician to aid the clinician in his attempts at diagnosis.

Numerous studies of the type presented here are needed; since the majority of the published surveys have used only small groups of multiple sclerotics.

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3 Aaron Herman Canter, Direct and Indirect Measures of Psychological Deficit in Multiple Sclerosis, in Journal of General Psychology, Vol. 44, First Half, Part I, issue of January 1951, p. 14.

4 Id. ibid., p. 10.

In all cases: "Interpretation must be cautious, owing to the small number of subjects[5]".

3. A Survey of the Literature.

In order to illustrate still further why we believe that our study can be a contribution of some importance, we will now attempt a brief but adequate coverage of the psychological literature on the intellectual factor in multiple sclerosis.

The various studies can be considered under three headings:

A. Qualitative descriptions resulting from subjective observations.
B. Quantitative analyses based on objective tests.
C. Comparative studies in which multiple sclerotics are compared to other diseases, especially to cases of intra-cranical pathology.

A. Qualitative descriptions.-- In former days, before the era of the extensive use of tests, qualitative descriptions based on observations were the only source of information. Any intellectual and behavioural changes had to be detected without instruments. Sugar and Nadell state adequately the situation that was found only eight years ago:

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5 W.C. Diers and O.C. Brown, Psychometric Patterns Associated With Multiple Sclerosis; Wechsler-Bellevue Patterns, in Archives of Neurology and Psychiatry, Vol. 63, No. 5, issue of May 1950, p. 765.

> A careful study of the American literature on Multiple Sclerosis reveals a paucity of material dealing with its mental symptoms. The articles on the subject have come mainly from psychiatric sources and have dealt exclusively with frank psychoses. Most studies of larger series are concerned primarily with somatic symptomatology and its pathological correlates, and mention the mental symptoms only secondarily. There have been attempts in the American literature to study systematically a large series with the specific purposes of determining the mental manifestations of the disease[6].

The most important contributions[7] were those of: (1) Charcot who started serious investigations by stating that there was marked enfeeblement of the memory, slow formation of conception and blunting of all intellectual and emotional faculties; (2) Cottrell and Wilson found only negligible intellectual defects but characteristic and marked emotional changes.

B. Quantitative approach.-- In these last few years, a new trend has developed. Burgemaster and Tallman have been among the firsts of a small group of investigators to utilize standardized psychological tests for the differential diagnosis of multiple sclerosis. They report:

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6 C. Sugar and R. Nadell, Mental Symptoms in Multiple Sclerosis: A Study of 28 Cases With Review of the Literature, in Journal of Nervous and Mental Disease, Vol. 98, No. 3, issue of September 1943, p. 267.

7 Id. ibid., p. 267.

> Wechsler-Bellevue scores range from 80-135 with the group mean at 101. (. . .) A wide discrepancy between remote and recent memory (. . .) suggest a lowering of the present level of functioning and the difficulty in assimilating new material quickly[8].

The Wechsler-Bellevue intelligence scale has recently been used in an investigation by Canter. He confirms Burgemaster's finding that there appears to be an intellectual constriction and impoverishment which is out of keeping with the educational and cultural background of the multiple sclerotic patients[9].

By means of the Wechsler-Bellevue test, Diers and Brown[10] have carried an investigation on the psychometric patterns associated with multiple sclerosis. Twenty-four patients (only twenty were able to complete the total test) were a group of World War II american veterans. Statistical results showed significant departures from "normal" performances in two respects: (1) a low memory span for digits forward and backward; (2) a better than average visual concentration and attention in the Picture Completion subtest. The correlation of test measures of intellectual

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8 W.C. Diers and C.C. Brown, Op. cit., p. 761.

9 Canter, Op. cit., p. 10.

10 Diers, Op. cit., p. 765.

deterioration and quantitative "signs" of organic cortical damage was not found to be significant. Either the index of deterioration on the Bellevue Scale, is inadequate as an indicator of existing cortical damage in multiple sclerosis, or, no cortical pathologic changes existed in the population. We may point out that full details of the procedures used by these authors are not given.

The most recent investigation of intellectual deterioration in multiple sclerosis is that of Canter[11] using the following tests: The Wechsler-Bellevue, the short form of the Babcock Scale, the Shipley-Hartford Test, and the short form of the Hunt-Minnesota Test. Each of these tests revealed the presence of some intellectual deterioration in a group of forty-seven patients. Intellectual deterioration, as measured both by direct and indirect methods, increased with the neurological rating of degree of disability. The mean loss over an average period of four years was highly significant, and indicated that intellectual deterioration had occurred in this group of twenty-three individuals tested at the moment of entry into the armed forces.

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11 Canter, loc. cit., p. 10.

At about the same time, Pratt[12] in England undertook an investigation of the psychiatric aspect of multiple sclerosis. In his paper, a report was made of one hundred patients. Three findings relevant to the assessment of intellectual impairment were noted, namely, a complaint of failing memory, a clinical impression of intellectual impairment, and a conceptual quotient below seventy (with a Vocabulary score of twenty-four or above) on the Shipley-Hartford Scale (1940).

C. Comparative studies.-- Two papers can be considered as being comparative studies.

Hewson's study of organic brain pathology included thirteen cases of multiple sclerotics. In conclusion she states:

> There is here an almost even distribution of patterns of deviation, one-third being normal, one-third being psychoneurotic, and one-third being indicative of a cerebral pathology. Of course, there is no assurance that this proportioning would hold in a larger group[13].

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12 K.T.C. Pratt, An Investigation of the Psychiatric Aspects of Disseminated Sclerosis, in Journal of Neurology, Neurosurgery and Psychiatry, Vol. 14 (new series), No. 4, issue of November 1951, p. 332.

13 Louise R. Hewson, The Wechsler-Bellevue Scale and the Substitution Test as Aids in Neuropsychiatric Diagnosis, in Journal of Nervous and Mental Disease, Vol. 109, Part I and II, No. 2, issue of February 1949, p. 176.

While investigating the intellectual aspect of multiple sclerosis, Pratt[14] mentioned that anxiety, hysteria, and psychotic behaviour were not found in cases of these patients.

4. Statement of the Problem.

Having discussed the preliminary notions, we can now state the problem of the present project in the form of three hypotheses:

1) Multiple sclerotics have a common pattern on the Wechsler-Bellevue Scale, Form I. The hypothesis implies that every multiple sclerotics will show the similar weaknesses and/or successes on the different abilities called forth by the different subtests of the scale. Whatever impairment there may be, it is expected to be reflected on the different subtests. The hypothesis rests on suggestions made in former studies and on a statement made by Wechsler:

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14 Pratt, Op. cit., p. 335.

> Whenever a mental disorder produces a change in the individual's functioning capacity, the resultant loss is generally not uniform, but affects certain abilities more than others[15].

2) The second Hypothesis is as follows: The pattern obtained by multiple sclerosis patients resembles the pattern obtained by cases of organic brain pathology.

This hypothesis rests on the fact that the disease attacks the substance of the nerve tissue. It can be suspected that these patients may behave similarly to brain damaged patients on the Bellevue Scale. Burgemaster and Tallman[16] mentioned that numerous features point to an organic basis for this impairment. There is a large number of investigations carried out with the latter group, but only the results of a few important ones will be compared with this investigation.

3) Multiple sclerotics show a significant degree of mental deterioration. On the basis of what other investigators have found, it is assumed that our subjects will perform poorly on the so-called "Don't Hold Test".

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15 David Weohsler, The Measurement of Adult Intelligence, Baltimore, The Williams & Wilkins Co., 1944, p. 146.

16 Diers, Op. cit., p. 701.

In this chapter, the problem of research was described and discussed in its various phases. A definition was given for the disease multiple sclerosis. The discussion on the importance of psychological examination was backed by a few references from previous investigators. Also, a covering of the literature on this problem showed the paucity of experimentation in this field of endeavour. Lastly the hypotheses on which the problem is based were presented and discussed.

CHAPTER II

EXPERIMENTAL DESIGN

In the first chapter, the statement of the problem has been introduced and discussed. This second chapter, first, describes the multiple sclerosis population. Then, this is followed by a description of the methods used in the study of each of the three hypotheses.

1. The population.

The population used in this investigation consisted of sixteen patients diagnosed by neurologists as multiple sclerotics. Except for one individual confined to bed, the members of the group belong to the Ottawa Chapter of the Multiple Sclerosis Society.

A relatively small group was available because it was planned to test only patients who were as close as possible to normalcy; i.e. patients in whom the degree of tremor would not influence the quantitative results of the performance aspect of the Wechsler-Bellevue test. Patients were chosen who were mild and moderate cases of multiple

sclerosis or who happened to be between the relapses or remissions of their disease. The results of an investigation have revealed that there was a significant difference between mild and moderate cases of multiple sclerotics on the one hand and severe cases on the other hand[2]. Some patients are gainfully employed while others are engaged in housework.

A further limitation was introduced: the investigator checked by personal testimony, to determine whether or not there were defects of sight and audition before administering the test.

Some of the characteristics of the sample are found in Table I. Here, six male patients were in the age range from thirty to fifty years with a mean age of thirty-six. Their educational achievement ranged from grade eight to third year college, with a mean of grade eleven for the group. Their Wechsler full scale intelligence quotient ranged from the dull normal to the bright normal classifications, with a mean I.Q. of 108.

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2. R.T.C. Pratt, An Investigation of the Psychiatric Aspects of Disseminated Sclerosis, in the Journal of Neurology Neurosurgery and Psychiatry, Vol. 14 (new series), No. 4, issue of November 1951, p. 333.

TABLE I.-

Distribution of Sixteen Multiple Sclerotic Patients on the Basis of Age, Education and Wechsler I.Q.

Sex	N	Age		School Grades		Wechsler IQ.	
		Range	Mean	Range	Mean	Range	Mean
M	6	30-50	36	8-15	11	88-115	108
F	10	26-56	37	[illegible]-16	10	76-115	99

The ten female sclerotics were in the age range from twenty-six to fifty-six, with a mean of thirty-seven years. Their educational achievement ranged from grade two to the bachelor of arts degree, with a mean of grade ten. Their Wechsler full scale intelligence quotients ranged from the borderline to the bright normal classifications, with a mean I.Q. of ninety-nine.

Table II shows the distribution of Wechsler Full Scale Intelligence Quotients. It will be noted that no subjects are found above the bright normal group and only one low-scoring individual is found at in the borderline group. The greatest number of patients obtained I.Q. scores in the average and bright normal groups.

A summary as to the culturo-environmental factors is as follows: all are residents of the city of Ottawa, and they have lived all or the major portion of their life here. Four patients are living in an invalid home. Every patient was aware of the nature of his illness and all had had the opportunity of meeting other sclerotics.

TABLE II.-

Distribution of Full Scale Intelligence Quotients.

Classifications	Range of I.Q.	Number of patients
Very Superior	128+	0
Superior	120-127	0
Bright-normal	111-119	5
Average	91-110	8
Dull-normal	80-90	2
Borderline	66-79	1

All subjects are English speaking or predominantly English speaking. Half the group are of Anglo-Saxon descent while four subjects are of Irish, two of Scottish, one each of French and Jewish origins.

The psychotechnician had the full cooperation of all testees. None objected to the test and all patients wanted to contribute to the further knowledge of their illness. It can be also mentioned that none of the subjects showed any signs of either eutonia or of euphoria.

2. The method.

a) Administration of the ten subtests.-- The instrument used in this investigation was the Wechsler-Bellevue Intelligence Scale Form I. It was primarily selected because it is well suited to study the nature of mental deterioration in organic diseases. Above all it has the advantage of being an individual test whereby clinical data may be gathered during the testing situation.

> Experience with the Bellevue-Wechsler test used over a period of eight years at the Boston Psychopathic Hospital, leads us to believe that is it a superior test because it can be administered with relative ease, it has been standardized on adults over a wide age range, it has the flexibility of a point scale with possibility of direct comparison of performance on various test items; and also because it taps a wide range of functions and elicits data of considerable value and interest to the clinician. In the group of cases characterized by the term "brain damage", this test would seem to be of special value for both diagnosis and investigation[3].

For this study only ten subtests of the scale were submitted to the group of sclerotics. The Vocabulary subtest was omitted because there were neither new norms nor any adaptation of it for our area. Only one subtest was slightly adapted for the Ottawa population and the surrounding district. Although, no new norms were established, the adapted test has been used at the Vocational Guidance Center of the University of Ottawa.

The Information subtest was the only one to be substantially changed. The following questions were modified: Question 1; "Who is the President of the United States"? Question 2; "Who was President before him"?

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3 Goldman, H.M. Greenblatt and C.P. Coon, Use of the Bellevue-Wechsler Scale in Clinical Psychiatry, in the Journal of Nervous and Mental Disease, Vol. 104, No 2, issue of August 1946, p. 178.

Question 9; "How tall is the average American woman"? Question 15; "What is the population of the United States"? Question 16; "When is Washington's birthday"? The corresponding substituted questions were as follows: "Who is the Canadian Prime Minister"? "Who was Prime Minister before him"? "How tall is the average Canadian woman"? "What is the population of Canada"? "When is Victoria Day"? The other subtests were left intact.

b) Study of the first hypothesis.-- The first psychodiagnostic theory in mental testing described here was one advanced by David Wechsler[3]. By his method, a psychometric pattern for the multiple sclerotic group could be obtained when the mean score of both the Verbal and the Performance subtests were used as a basis for the computation of the deviations for each subtest score.

The problem that arose at this point, was the establishment of what constitutes a significant variant score. Although, no tables of norms were established for different clinical entities, Wechsler suggests that sufficient approximations may be had by the following rule of thumb. For total scores on the full

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3 Wechsler, D., op. cit., p. 146-167.

scale lying within 80 - 110, a significant deviation was roughly obtained by dividing the mean subtest score by four.

The general clinical problem of test patterning consists of establishing associations between particular test score divergencies and specific clinical entities. The method that Wechsler has found most adaptable for clinical use is that of "counting" or integrating signs. He defines a "sign" or symptom as a significantly low subtest score which has been found to be characteristic of, or associated with, a particular type of mental disorder or dysfunction.

For the population in the normal I.Q. range, counting deviations in terms of weighted scores, Wechsler used the symbols in the following way: [4]

A deviation of 1.5 to 2.5 units above the mean subtest score has this sign:	+
A deviation of 3 or more units above the mean subtest score has this sign:	++
A deviation of 1.5 to 2.5 units below the mean subtest score has this sign:	-
A deviation of 3 or more units below the mean subtest score has this sign:	--
A deviation of ±1.5 to -1.5 from the mean subtest score has this sign:	0

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4 Id. ibid., p. 153.

In line with our first hypotheses the results of the sclerotic population were studied and were subjected to statistical computations.

The statistical procedures used were the same throughout and can be presented in a few paragraphs. Since the arithmetical mean is generally the most widely used descriptive index for central tendencies, it was used as a basis for our computations.

In order to ensure that observed differences are not merely a reflection of chance fluctuation due to sampling error all differences were tested for statistical significance. In other words, our results must be tested in order to determine if the degree of propability of a certain result occuring would allow for the deduction of valid conclusions.

Since social sciences (psychological and others) face greater difficulties in obtaining a perfect sample, we must compensate this by using more rigour in the selection of a level of probability; although the 1% level of confidence is usually advocated[5], the 5% level will be tolerated at times in this study.

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5 Quinn Mc Nemar, Psychological Statistics, New York, Wiley and Sons, 1949, p. 69.

Since the population used in this study is rather small, we will use the critical ratio "t" to determine the degree of probability between mean differences, thus utilizing table E of Psychological Statistics[6].

The formulas used here are those given by many authors. The CR "t" is obtained like the usual CR:

$$\frac{D_M}{\sigma_{D_M}} = \frac{M_1 - M_2}{\sigma_{M_1} - \sigma_{M_2}}$$

The denominator of this ratio is obtained by this formula:

$$\sigma_{D_M} = \frac{\sigma_D}{N-1}$$

the M_1 and M_2 of these formulas are the two means the difference of which we must establish the significance.

"t" differs from a CR in that:

$$n = N - 1$$

is used rather than N.

The "t" ratios found here, have been treated after the manner elaborated by Mc Nemar[7].

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6 Id. ibid., p. 352.

7 Id. ibid., p. 71 - 72.

To make this study more complete a combination of Wechsler's and Allen's methods will be used. Thus, Wechsler's rules of thumb will be applied but the deviations or "signs" will be computed from the mean Information subtest score only. Wechsler's "signs" will be used in order to establish a pattern for multiple sclerosis patients.

Even though Wechsler's method has been more extensively used than Allen's, the relative merits of the two methods have not been investigated. Allen claimed that the subtests of Information, Comprehension and Vocabulary were least susceptible to deterioration due to brain damage in the individual[7].

Again it will be helpful to check the results obtained with the "sign" method, by using statistical devices for computing significant defferences between the deviating subtests. The critical ratio "t" is once more useful for this purpose.

Ultimately, the two patterns obtained by means of these two methods will be compared and followed by a discussion.

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7 Allen R.M., The Test Performance of the Brain Injured, in the Journal of Clinical Psychology, Vol. 3, No. 3, issue of July 1947, p. 229.

Our results will be compared to the only other Wechsler-Bellevue pattern established for multiple solerotics. This pattern was found by Diers and Brown[8] using Wechsler's method. The comparisons with their data will be limited, because they have presented their article in a very compact style, and with little detail.

The last section treating with the first hypothesis will include a brief discussion on the qualitative aspect of mental testing.

c) Study of the second hypothesis.— The second hypothesis proposed is that the pattern of multiple solerotics resembles that obtained from subjects with organic pathology. The psychological literature contains numerous studies done on brain damaged patients, and as a consequence, many methods were originated and developed with the Wechsler-Bellevue.

Wechsler has established a pattern for his group of organic patients[9]. The pattern obtained for our solerotic population by means of his method of "signs" will be compared to his data on organic cases.

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8 Diers and Brown, op. cit., p. 762.

9 Wechsler, D., op. cit., p. 150.

A table will present the frequency of appearance of organic "signs" found in each multiple sclerotic individual. Another table will indicate the frequency and percentage of appearance of organic "signs" in each subtest, and this will be compared to the findings of Diers and Brown[10].

Wechsler's organic pattern is as follows:

Information (Inf.)	+
Comprehension (Comp.)	+
Digit Span (D. Span)	--
Arithmetic (Arith.)	-
Similarities (Sim.)	-
Vocabulary	++
Picture Arrangement (P.A.)	0
Picture Completion (P.C.)	0
Block Design (B.D.)	-- to 0
Object Assembly (O.A.)	0 to --
Digit Symbol (D. Symb.)	--
Verbal I.Q. higher than Performance I.Q. (V.P.)	

Secondly, our multiple sclerotic group will be compared to Allen's organic pattern[11]. As mentioned before, only the Information subtest zero point for the computation of deviations will be used. Once more, the frequency of organic "signs" will be estimated in each case and in each subtest.

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10 Diers and Brown, op. cit., p. 764.

11 Allen, op. cit., p. 257.

Allen's organic pattern, for patients with brain injuries, translated into Wechsler's symbols is as follows:

Comprehension	0
Digit Span	--
Arithmetic	-
Similarities	-
Picture Arrangement	-
Picture Completion	-
Object Assembly	--
Block Design	--
Digit Symbol	--

Verbal I.Q. higher than Performance I.Q.

Among the many investigators in psychodiagnostic testing, some believed that a more refined method than scattergrams gave results which were more discriminating and more reliable.

One of these was Hewson's method[13] which consists of the manipulation of combinations of scores in various ways so as to yield ratios. She has formulated ratios in an attempt to find evidence of psychological impairment in types of head injuries other than the concussive type, and in other kinds of cerebral pathologies. These ratios were established upon the observations of deviation tendencies of the weighted scores of the individual test items above and below the patient's average weighted score. Ten ratios were devised after observation of trends in different types of brain pathologies. The interpretation of a single deviant quotient depends to some extent upon

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13 Hewson, op. cit., p. 161.

the pattern expressed by the combination of all the ratios. Depending on the size of the resulting index the performance of the individual may be classified in a manner similar to brain pathology cases, psychoneurotics (anxiety types), or to normals.

The ratios thus formulated by Hewson are as follows[14]:

Formulas	Range of significance by category:		
	Psychoneurosis	Normal	Organic
I $\frac{\text{P.A.} + \text{P.C.}}{\text{Arith.} + \text{D.Symb.}}$	0 - .6	.7 - 1.2	1.3 +
II $\frac{\text{Inf.} + \text{Comp.}}{\text{Arithmetic}}$	0 - 1.7	1.8 - 2.9	3.0 +
III $\frac{\text{Inf.} + \text{Comp.}}{\text{D.Span} + \text{D.Symb.}}$	0 - .9	1.0 - 1.6	1.7 +
IV $\frac{\text{Inf.} + \text{Comp.}}{\text{P.A.} + \text{D.Symb.}}$	0 - .8	.9 - 1.5	1.6 +
V $\frac{\text{Inf.} + \text{Comp.}}{\text{Digit Symbol}}$	0 - 1.7	1.8 - 3.4	3.5 +
VI $\frac{\text{Inf.} + \text{Comp.}}{\text{D.Span} + \text{P.A.} + \text{D.Symb.}}$	0 - .5	.6 - 1.0	1.1 +
VII $\frac{\text{D.Span} + \text{D.Symb.}}{\text{Sim.} + \text{B.D.}}$	1.1 +	.6 - 1.0	0 - .5
VIII $\frac{\text{Comp.} + \text{P.A.}}{\text{Digit Symbol}}$	0 - 1.5	1.6 - 2.9	3.0 +

This study did not require the use of ratios IX and X.

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14 Ibid., p. 161.

To interpret the data, Hewson has developed a summary diagnostic judgement (J) which reveals the deviation pattern from ratios I through VIII. The probability of abnormal intellectual functioning because of a cerebral pathology, either structural or physiological, is indicated by a black "J".

The rules[15] for determining "J" for psychoneurosis, organic, and "normal" are described below:

Psychoneurosis:

(1) The psychoneurosis sign is the only deviant ratio between I and VIII, except if the only psychoneurotic sign occurs in ratios II, V or VIII; or on combination of these ratios then; "J" to normal.
(2) the only organic diagnosis is number II; the psychoneurotic ratios may or may not be present;
(3) the ratio I and II are the only organic signs and the Digit Symbol score is below the mean of the subtests;

Normal:

(1) All the ratios from I to VIII are "normal";
(2) the only deviant ratio between I and VIII is a psychoneurotic sign on ratio II, V, VIII or any combinations of these.

Organic:

(1) Ratio I is organic and Digit Symbol score is below own average score;
(2) any other ratio from I through VIII is organic unless the only organic sign is on ratio II; then "J" is psychoneurotic, the presence of psychoneurotic signs does not contradict the "J" if conditions meet requirements in these two rules.

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15 Hewson, op. cit., p. 165.

The severity and extent of the intellectual weakness or deterioration are expected by the number of organic ratios which contribute to the black "J".

d) Study of the third hypothesis.-- The third hypothesis of this experiment is that multiple solerosis patients will show a significant degree of mental deterioration.

Since these patients suffer from a neurological disease with an organic basis, it is logical to expect that they behave like the usual organic brain damaged individuals that is, in showing mental deterioration.

The two methods utilized to determine the degree of deterioration are Wechsler's Mental Deterioration Index[16] and Allen's Mental Deterioration Index[17]. These methods assumed that some subtests of the Wechsler-Bellevue Scale are more resistant than others to organic mental deterioration.

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16 Wechsler, D. Op. cit., p. 54 - 69.

17 Allen, R.M., A Note on the Use of the Wechsler-Bellevue Scale Mental Deterioration Index With Brain Injured Patients, in J. of Clinical Psychology, Vol. 4, No. 1, issue of January 1948, p. 88.

According to Wechsler, the subtests of Vocabulary or Comprehension, Object Assembly, Picture Completion and Information are "Hold Tests" which means that they are more resistant to mental deterioration due to age and due to organic defects of the brain than the "Don't Hold Tests" that consist of the following subtests: Digit Span, Arithmetic, Digit Symbol, Block Design and Similarities.

In obtaining the mental deterioration index, it is necessary to substitute the respective subtests scores in the following formula:

$$\frac{\text{Hold Tests} - \text{Don't Hold Tests}}{\text{Hold Tests}} \times 100 = \% \text{ deterioration loss.}$$

According to this technique, a significant mental deterioration in a pathological sense is defined as "possible deterioration" and as "definite deterioration" when there are respectively ten percent and twenty percent losses more than that which would be accounted for by the normal decline with age. Allowance for normal deterioration loss attributable to decline with age will be taken into consideration (Wechsler, Table II, p. 66).

The second method to be used in computing mental deterioration due to organic impairment is that of Allen.

On a purely statistical basis, he suggests a deterioration quotient based on the same formula as Wechsler's, except that Allen's "Hold Tests" and "Don't Hold Tests" are slightly modified. The subtests included in the "Hold Tests" are Information and Comprehension. The "Don't Hold Tests" consist of Digit Span and Digit Symbol. The resulting weighted scores of approximately five points or more show significant mental deterioration.

Fortunately, the psychological literature offers a critique on the value of these mental deterioration indices.

Blake[18] reports that seventy-four percent of his sample are well classified as either having an organic basis or not when Wechsler's formula is used, while Allen's method classified only thirty-four percent correctly.

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18 Blake, R.R. and B.S. McCarthy, A Comparative Evaluation of the Bellevue-Wechsler Mental Deterioration Index Distributions of Allen's Brain Injured Patients and of Normal Subjects, in J. of Clinical Psychology, Vol. 4, No. 4, issue of October 1948, p. 417.

In another report, Rogers[19] concludes that Wechsler's Mental Deterioration Index distinguishes normals from abnormals (organics) on a three to one ratio, while Allen's Index distinguishes on a two to one basis. Their results and those of Blake and McCarthy indicate that the Allen's index is somewhat less discriminative than the Wechsler M.D.I. so far as normal subjects are concerned.

In a recent article by Gutman[20], it is concluded that the Hewson formula seems to be a better method for diagnosis than Wechsler's Index in that it yielded a sixty percent discrimination compared with a forty-three percent discrimination for Wechsler's.

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19 Rogers, Lawrence S., A Note on Allen's Index of Deterioration, in Journal of Clinical Psychology, Vol. 6, No. 2, issue of April 1950, p. 203.

20 Gutman, Brigette, The application of the W-B. scale in the Diagnosis of Organic Brain Disorders, in Journal of Clinical Psychology, Vol. 6, No. 2, issue of April 1950, p. 195 - 198.

This chapter has described materials and tools used in this experiment.

In the description of the population, the factors of age, sex, intelligence, educational level, racial origin and the degree of cooperativeness were taken into consideration.

Reasons for selecting the Wechsler-Bellevue Scale and reasons for its modifications to suit our purposes were given.

Finally, the methods to be utilized in testing the three hypotheses were explained and a critique of these methods was introduced whenever possible.

CHAPTER III

THE MULTIPLE SCLEROSIS PATTERN

In Chapter II, the population and the instruments of research were described, then the methods utilized for either rejecting or for accepting the hypotheses were also presented.

This chapter will report on the testing of the first hypothesis; namely, that multiple sclerotics conform to a common pattern on the Wechsler-Bellevue scale. It is expected that all patients will show the same impairments in some or on all their mental abilities. It is assumed that the Wechsler-Bellevue measures different mental abilities at the same level of functioning.

In order to check this first hypothesis, measures of central tendencies will be presented, followed by a description of the dispersion of the subtest around various points of reference. The points of reference used in this study will be the mean score of the subtests and the Information subtest score. Then, our results will be compared to those obtained by Diers and Brown[1].

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1 W.C. Diers and C.C. Brown, Psychometric Patterns Associated With Multiple Sclerosis; Wechsler-Bellevue Patterns, in Archives of Neurology and Psychiatry, Vol. 63, No. 5, issue of May 1950, p. 760-765.

1. Description of Results.

Before conducting an analysis of the different patterns obtained by multiple sclerotics, it is appropriate to have a general picture of the intelligence quotients of the group as a whole.

In Table III, the range, the mean and the sigma of the intelligence quotient results of the sixteen multiple sclerotics are presented. These results for the whole group showed that they performed best in the verbal aspect of the scale. In the total scale, the results of the group classified the patients from the borderline intelligence to the bright-normal, with a mean of average intelligence. The Verbal and the Performance quotients ranged from borderline to superior intelligence, with a mean of average intelligence. The largest sigma was in the Performance scale and the lowest sigma in the total scale.

Table IV presents the range, the mean and the sigma of each subtest for the total group of sclerotics. The widest range in weighted score results occurred in the Arithmetic subtest, with a fifteen unit spread, while the smallest range spread of eight units was obtained in the Digit Symbol subtest.

TABLE III.-

Range, Mean and Sigma of IQ. Results of a Group of Multiple Sclerotics on the Wechsler-Bellevue Intelligence Scales (N.16).

	Range	Mean	Sigma
Total Scale	76-115	102.375	11.453
Verbal Scale	71-120	104.5	13.709
Performance Scale	77-122	98.125	14.016

TABLE IV.-

Range, Mean and Sigma of Weighted Scores Results of Each Subtest in a Group of Multiple Sclerotics (N.16).

Subtests	Range	Mean	Sigma
Information	3-14	11.0	3.78
Comprehension	5-16	11.27	3.12
Digit Span	2-11	6.73	2.62
Arithmetic	1-16	9.0	3.97
Similarities	6-15	10.8	2.87
Picture Arrangement	4-14	8.87	2.55
Picture Completion	6-15	9.33	2.75
Block Design	4-13	8,46	2.75
Object Assembly	0-12	8.8	4.07
Digit Symbol	2-10	6.53	2.63

The group obtained its lowest mean score on the Digit Symbol subtest, while the highest mean weighted score was obtained on the Comprehension subtest.

The Picture Arrangement subtest had the lowest variability, while the Object Assembly subtest had the highest sigma value.

These data enabled us to draw up a Wechsler profile of the group considered as a whole. Figure 1 represents this profile of our multiple sclerotics.

At the top of Figure 1, the vertical columns are identified by the subtest titles. On the left hand side of the illustration, the equivalent weighted scores are disposed from top to bottom in order that these may give a common basis for comparing subtest scores. In the vertical columns under each subtest, the results obtained are in terms of raw scores, but those can be easily converted into weighted scores by means of the equivalent weighted score columns located at the extreme left and right hand sides.

The mean score of the ten subtests for the group was found to be 9.1. Remembering this, a visual inspection of Figure 1 reveals that the most impaired subtests are those of Digit Symbol, Digit Span, Block Design, Object

TABLE OF WEIGHTED SCORES†

Equivalent Weighted Score	RAW SCORE											Equivalent Weighted Score
	Information	Comprehension	Digit Span	Arithmetic	Similarities	Vocabulary	Picture Arrangement	Picture Completion	Block Design	Object Assembly	Digit Symbol	
18	25	20		14	23-24	41-42	20+		38+			18
17	24	19	17	13	21-22	39-40	20		38	26		17
16	23	18	16	12	20	37-38	19		35-37	25	66-67	16
15	21-22	17		11	19	35-36	18	15	33-34	24	62-65	15
14	20	16	15		17-18	32-34	16-17	14	30-32	23	57-61	14
13	18-19	15	14	10	16	29-31	15	13	28-29	22	53-56	13
12	17	14		9	15	27-28	14	12	25-27	20-21	49-52	12
11	15-16	12-13	13		13-14	25-26	12-13		23-24	19	45-48	11
10	13-14	11	12	8	12	22-24	11	11	20-22	18	41-44	10
9	12	10	11	7	11	20-21	10	10	18-19	17	37-40	9
8	10-11	9			9-10	17-19	9	9	16-17	16	33-36	8
7	9	8	10	6	8	15-16	7-8	8	13-15	14-15	29-32	7
6	7-8	7	9	5	7	12-14	6	7	11-12	13	24-28	6
5	6	5-6			5-6	10-11	5		8-10	12	20-23	5
4	4-5	4	8	4	4	7-9	4	6	6-7	10-11	16-19	4
3	2-3	3	7	3	3	5-6	2-3	5	3-5	9	12-15	3
2	1	2	6		1-2	3-4	1	4	1-2	8	8-11	2
1	0	1		2	0	1-2	0	3	0	7	4-7	1
0		0	5	1		0		2		5-6	0-3	0

Figure 1. Psychometric Profile of the Multiple Sclerotic Group in Terms of Weighted Score Units.

Wechsler-Bellevue Intelligence Scale for Adolescents and Adults Record Form I, New York, Psychological Corporation, 1947.

Assembly, Picture Arrangement and Arithmetic which deviate negatively from the mean subtest. The subtests of Comprehension, Information, Similarities and Picture Completion deviate positively. These deviating subtests were presented in the order of greatest to least deviations. This configurational pattern indicates only that our sclerotics have produced an unusual group profile. The significance of the deviating subtests must be established in order to arrive at the psychometric pattern sought.

2. The Mean Score Pattern.

Wechsler's method of obtaining a pattern is based on the deviation of the various subtests from the mean score of those subtests. The rules that govern the use of this method were given in Chapter II.

Table V presents the pattern obtained when Wechsler's method of "signs" was applied. In this illustration there are four columns. The subtest scores represent the mean weighted scores obtained by the whole group of sclerotics on each subtest. These are followed by the deviations of the mean weighted scores for each subtest from the weighted mean score of 9.1. In the extreme right

TABLE V.-

The Multiple Sclerosis Pattern Based on the Deviations From the Mean Subtest Score of 9.1.

Subtests	Subtests scores	Deviations	"Signs"
Information	11.0	1.9	+
Comprehension	11.27	2.27	+ to ++
Digit Span	6.73	-2.37	- to --
Arithmetic	9.0	-0.1	0
Similarities	10.8	1.8	+
Picture Arrangement	8.87	-0.23	0
Picture Completion	9.33	0.23	0
Block Design	8.46	-0.63	0
Object Assembly	8.8	-0.3	0
Digit Symbol	6.53	-2.57	- to --
Verbal>Performance		5.1	0

hand column, the "signs" are established to show the significant deviation of each subtest in the Wechsler scale as applied to the Multiple Sclerotic group.

In assigning the symbols we have used the procedures described by Wechsler to a subject who falls in the normal range of the general population. This was done because the mean intelligence quotient of our group was found to be 102.37.

The pattern revealed that significant positive deviations were found in subtests for Information, Comprehension and Similarities. The significant negative deviations were obtained in the subtests for Digit Symbol and Digit Span.

Since Wechsler's concept of significance rests on an arbitrary decision, the question may be asked whether these clinically significant deviations are in fact statistically significant. Table VI presents the data used in attempting to answer this question.

This Table includes the major steps in the statistical procedures we have used to establish the significant difference between each mean subtest and the mean of the total ten subtests of the scale. The statistical difference between the correlated means of each subtest with the whole test was utilized.

TABLE VI.-

Significant Positive or Negative Deviation of Each Subtest from the Total Mean Subtest Weighted Score (9.1).

Statistics	Inf.	Comp.	D.Span	Arith.	Simil.
N	16	16	16	16	16
M	11	11.27	6.73	9.0	10.8
M_1	9.1	9.1	9.1	9.1	9.1
σ_M	0.72	0.81	0.677	1.03	0.743
M_D	1.96	2.226	-2.387	0.36	1.693
σ_{D_M}	0.387	0.41	0.566	0.87	0.489
t	5.062*	5.433*	-4.212*	0.414	3.458*

Statistics	Pict.Arr.	P.C.	Bl.D.	Obj.A.	D.Symb.
N	16	16	16	16	16
M	8.87	9.33	8.47	8.8	6.53
M_1	9.1	9.1	9.1	9.1	9.1
σ_M	0.66	0.71	0.711	1.05	0.68
M_D	-0.76	0.547	-0.653	-0.44	-2.573
σ_{D_M}	0.643	0.366	0.495	0.202	0.418
t	-1.181	1.494	-1.32	-2.179**	-6.162*

*t: 0.01 level of probability; 2.947
**t; 0.05 level of probability; 2.131

The symbol (N) represents the constant number of sixteen multiple sclerotics. The symbol (M) is the mean subtest score of each mean score obtained by the group on each subtest. The symbol (M_2) is the mean score of all the subtests. The sumbol (σ_M) is the standard error of each mean subtest score. The symbol (Mp) is the statistical difference between the mean of each subtest score with the mean score of the ten subtests. The symbol (σ_{D_M}) is the standard error of the difference between each mean subtest score with the mean subtest score of the ten subtests. The symbol (t) is the critical ratio used for small samples (below 30 cases) in order to determine the significant difference between each subtest mean score and the total ten subtests' score of 9.1 units in weighted score. The discriminant ratios of 0.01 and 0.05 levels of probability were taken to estimate statistical significance of the differences. Since we are using the "t" technique a "df" of fifteen units is required. A table for the distribution of "t's" gives the critical points as 2.947 and 2.131 respectively at the 0.01 and at the 0.05 levels of probability. That is, a score value of a "t" above these two numbers will determine a statistical significance for the difference between the mean subtest score with any one subtest score. This difference would be greater in value than would be

expected from chance at this level of probability. One may not totally reject the possibility of significance, but according to chance there appears to be no statistical significance.

The results for the whole group found in Table VI indicated that the following subtests deviated significantly from the mean subtest of the whole scale: Digit Span, Digit Symbol and Object Assembly have deviated negatively, while the subtests of Information, Comprehension and Similarities have deviated positively. All these subtests were found to be significant at the one percent level of probability except for Object Assembly which was significant at the five percent level.

A comparison of results obtained from these two methods of establishing psychometric patterns showed that there was perfect agreement as to significance of deviations in the following subtests: Digit Span, Digit Symbol, Information, Comprehension and Similarities. From the results of these two techniques, it appeared that the same multiple sclerosis patternswere obtained. Since the Object Assembly was found significant at the five percent level of probability and did not show any significance in Wechsler's method, it appeared that the five percent level was not a satisfactory discriminatory level for the computation of deviations.

We can check the usefulness of the pattern of the whole population by applying it to each individual multiple sclerotic pattern. Table VII gives the patterns of each individual. According to the rules in Wechsler's theory of "signs", the significantly negative and positive deviating subtests are indicated by their corresponding "sign". For individuals having an intelligence quotient above or below 80 to 110 we have taken into consideration the rules Wechsler suggests for computing these "signs"[2].

In Table VII the columns are headed by the first letters designating the ten subtests. In the extreme left hand column the identifying case numbers are written for each pattern. The right hand column (V:P) indicates the "sign" for the Verbal I.Q. is greater than for the Performance I.Q.

These (V:P) "signs" are obtained from the data of Table VIII. When the critical ratio "t" is used, no statistical significant difference is found between the Verbal and the Performance I.Qs. for the group. A deviation of ten points or more is considered significant.

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2 David Wechsler, The Measurement of Adult Intelligence, Baltimore, the Williams & Wilkins Co., 1944, p. 146.

TABLE VII.-

Patterns of Sixteen Multiple Sclerosis Patients Based on Wechsler's "Signs".

Cases	Subtests										
	Inf.	Comp.	D.Sp.	Ar.	Si.	P.A.	P.C.	B.D.	O.A.	D.S.	V:P
1	0	0	-	+	+	0	-	0	0	0	0
2	+	+	-	0	0	0	0	-	+	-	+
3	+	+	-	+	0	+	+	0	0	-	0
4	+	+	--	-	++	+	0	0	+	--	0
5	0	+	--	0	0	0	0	0	0	0	0
6	0	+	0	-	+	0	0	-	+	-	0
7	+	+	0	0	++	--	-	0	0	--	+
8	+	0	-	--	0	0	++	0	0	--	0
9	+	+	--	0	--	0	+	+	0	--	-
10	0	+	0	0	-	0	0	0	0	0	+
11	+	0	--	0	0	0	-	0	+	0	0
12	0	0	0	++	+	0	0	--	--	0	+
13	0	++	-	-	+	++	0	-	-	--	0
14	-	0	--	--	+	0	++	+	+	--	+
15	++	+	--	++	+	--	0	--	--	--	+
16	++	0	0	+	0	0	0	-	--	--	+

TABLE VIII.-

The Statistical Significant Difference Between the Verbal and Performance Intelligence Quotients of Sixteen Multiple Sclerosis Patients.

Cases	Verbal I.Q.	Performance I.Q.	Difference in I.Q.	Full Scale I.Q.
1	117	111	6	115
2	104	93	11	99
3	112	114	-2	114
4	103	105	-2	105
5	114	116	-2	115
6	94	85	9	115
7	117	98	19	109
8	107	112	-5	110
9	107	122	-15	115
10	120	104	16	114
11	94	100	-6	96
12	102	77	25	90
13	97	95	2	95
14	71	86	15	76
15	119	88	31	105
16	95	84	11	88
Mean	104.5	99.4		103
CR "t"	1.7103			

The results summarized in Table IX indicate the amount of agreement existing between the individual multiple sclerotic patterns with the general pattern of the group which was obtained by Wechsler's method. Eighty-one per-cent of the group obtained at least half the number of sclerotic "signs" ranging from eight to six. The other three individual patterns possessed less than fifty-five percent of the "signs". Cases number four and five had patterns closest to the general pattern.

An explanation for this discrepancy was attempted. Case number twelve had expressed anxiety trends as revealed by Hewson's diagnostic judgment discussed in the following Chapter. As for case fourteen, no explanation was possible except that the patient had shown some reluctance to co-operate during the testing period. Lastly, case sixteen had previously passed some time in a mental hospital. No information was available concerning the nature of the mental illness.

Whether this general pattern of the multiple sclerotic group is useful or not depends on many factors. One of these is the fact that this quantitative pattern when interpreted as such sheds some doubt as to its utility in differential diagnosis. But, one should not forget that more favorable results might be obtained with a larger population.

TABLE IX.-

The Agreement of Individual Multiple Sclerotic Patterns With the General Pattern of the Group Obtained by Wechsler's Method.

Cases	Number of "signs"	Approximate % agreement
1	6	55
2	7	64
3	7	64
4	8	73
5	8	73
6	6	55
7	7	64
8	7	64
9	7	64
10	6	55
11	6	55
12	3	27
13	6	55
14	4	36
15	6	55
16	4	36

98

3. The Information Scatter Pattern.

One of Allen's methods of establishing a pattern is based on the computation of subtests deviations from the Information subtest weighted score. The rules governing the use of this method are the same as those for Wechsler's method as outlined in Chapter II.

Table X shows the pattern obtained when Allen's method is applied. In assigning the symbols, we use Wechsler's method except that the deviations are calculated from the Information subtest weighted score of 11.0, rather than the mean of the total subtests score of 9.1 units.

This pattern reveals that the significant negative deviations include those subtests of Digit Span, Digit Symbol, Block Design, Arithmetic, Picture Arrangement, Picture Completion and Object Assembly. Moreover, the two first subtests just mentioned above have very strong significance of deviations, and consequently are assigned a double negative sign for each. No significant positive deviation is found in any subtest. No statistical significance is found between the higher Verbal score and the Performance score.

The question now arises as to whether these clinically significant deviations are in fact statistically

TABLE X.-

The Multiple Sclerosis Pattern Based on the Deviations from the Information Subtest Score of 11.0.

Subtests	Subtests Scores	Deviations	Signs
Comprehension	11.27	0.27	0
Digit Span	6.73	-4.27	--
Arithmetic	9.0	-2.0	-
Similarities	10.8	-0.2	0
Picture Arrangement	8.87	-2.13	-
Picture Completion	9.33	-1.67	0
Block Design	8.47	-2.53	-
Object Assembly	8.8	-2.2	0
Digit Symbol	6.53	-4.47	--

significant. The same statistical procedures shown in Table VI are repeated in Table XI.

This check shows that the whole group indicated statistical significance in the following subtests: Digit Span, Digit Symbol, Block Design, Picture Arrangement, Arithmetic, Picture Completion and Object Assembly. All the subtests mentioned above deviate significantly at the one percent level of probability, except for the subtests of Object Assembly and of Picture Completion which are significant only at the five percent level of probability according to the critical ratio technique. Again, no statistically significant positive deviations were obtained.

When the results of these two techniques for establishing psychometric patterns were compared, it was seen that there was no perfect agreement in all the significant subtests of Allen's modified method with the statistically significant subtests at the one percent level of probability. This disagreement lies in the fact that the subtests of Picture Completion and of Object Assembly were statistically significant only at the five percent level.

Since Wechsler's "signs" agree completely with the one percent discriminant ratio, they appear to be better discriminatory points than Allen's modified "signs".

TABLE XI.-

Significant Positive or Negative Deviation of Each Subtest from the Information Subtest Weighted Score of 11.0.

Statistics	Inf.	Comp.	D.Sp.	Arith.	Simil.
N	16	16	16	16	16
M	11.0	11.27	6.73	9.0	10.75
σ_M	0.72	0.81	0.677	1.03	0.54
M_D		0.267	-4.33	2.13	0.266
σ_{D_M}		0.642	0.664	0.7	0.67
t		0.418	-6.521*	-3.04*	-0.397

Statistics	P.A.	P.C.	B.D.	O.A.	C.Symb.
N	16	16	16	16	16
M	8.87	9.33	8.47	8.8	6.53
σ_M	0.66	0.71	0.711	1.05	0.679
M_D	2.31	1.667	2.867	2.2	4.6
σ_{D_M}	0.653	0.642	0.631	1.003	0.755
t	-3.53*	-2.596**	-4.543*	-2.193**	-6.09*

* t = 0.01 level of probability : 2.947

** t = 0.05 level of probability : 2.131

The five percent level of probability has been discarded, and Picture Completion and Object Assembly subtests are given zero "signs" in Table X.

In Allen's modified method, as in Wechsler's technique, we looked into the usefulness of the second pattern obtained. Moreover, we attempted to see if the results of this pattern would either support or reject the assumptions of the first hypothesis.

Table XII includes all the multiple sclerotic patterns of each individual. When each of these patterns is compared with the general pattern found in Table X, the number and the percentage of multiple sclerotic "signs" is determined for each individual. These results are summarized in Table XIII.

Table XIII outlines the results obtained by Allen's modified method as compared to those obtained by means of Wechsler's method.

The results obtained from the use of these two procedures indicate an approximate equality of efficiency in quantitative diagnosis for the entire multiple sclerotic population. It is noticed that Wechsler's method is fifty-six percent efficient while Allen's method is fifty-three percent efficient.

TABLE XII.-

Patterns of Sixteen Multiple Sclerosis Patients Based on Allen's Information Subtest Weighted Score of 11.0.

Cases	Subtests									
	Comp.	D.Sp.	Ar.	Si.	P.A.	P.C.	B.D.	O.A.	D.S.	V:P
1	+	--	++	++	0	--	0	0	0	0
2	0	--	0	0	-	-	--	0	--	+
3	+	--	+	0	++	++	-	0	--	0
4	0	--	--	+	0	-	-	0	--	0
5	++	--	0	++	0	0	+	0	0	0
6	0	--	--	0	--	--	--	0	--	0
7	+	0	0	++	--	-	0	0	--	+
8	0	-	--	0	0	++	0	0	--	0
9	+	--	-	--	0	0	0	0	--	-
10	++	0	0	++	--	-	0	0	0	+
11	--	--	-	--	--	--	-	0	--	0
12	-	-	0	0	--	-	--	--	-	+
13	0	--	--	0	0	--	--	--	--	0
14	--	--	--	--	--	--	--	--	--	+
15	+	--	++	0	--	-	--	--	--	+
16	--	--	-	--	--	--	--	--	--	+

TABLE XIII.-

The Number and Percentage of Multiple Sclerotic "Signs" Found in Each Individual Patterns with Wechsler's and Allen's Modified Methods.

Cases	Wechsler's Method		Allen's Method	
	N	%	N	%
1	6	54.5	2	20
2	7	72.7	8	80
3	7	45.4	5	50
4	8	72.7	6	60
5	8	72.7	3	30
6	6	54.5	8	80
7	7	63.6	5	50
8	7	63.6	5	50
9	7	63.6	5	50
10	6	54.5	3	30
11	6	54.5	6	60
12	3	27.2	4	40
13	6	54.5	6	60
14	4	36.3	6	60
15	6	54.4	6	60
16	4	36.3	6	60
Signs	98		84	
%	56		53	

4. Pattern Comparison - Diers & Brown.

Having applied Wechsler's and Allen's methods to our group of sclerotics, we will now compare both the resultant psychometric patterns with the pattern established recently by Diers and Brown[3].

Table XIV contains all psychometric patterns of multiple sclerotics found to date. The first pattern at the left hand of the Table was obtained on the basis of the means of subtests, and the next pattern was obtained on the basis of the Information subtest scatter. The pattern of multiple sclerotics obtained by Diers and Brown was included for comparison. All the statistical significance of deviating subtests were found by the critical ratio "t".

Diers and Brown presented a series of analyses of their results, but showed too little detail and only a bare outline of their work.

When using the mean of subtests as the basis for the computation of deviations, there were agreements as to the corresponding levels of probability in both our patterns when compared with that of Diers in the following

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3 W.C. Diers and C.C. Brown, Psychometric Patterns Associated With Multiple Sclerosis; Wechsler-Bellevue Patterns, in Archives of Neurology and Psychiatry, Vol. 63, No. 5, issue of May 1950, p. 762.

TABLE XIV.-

Comparison of Multiple Sclerotic Patterns by Means of the Critical Ratio "t" When Based on the Mean Score of Subtests and the Information Subtest Score With That of Diers and Brown.

	Matter		Diers & Brown
	Mean Score	Information	Mean Score
Information	5.062*		1.864
Comprehension	5.433*	0.418	1.626
Digit Span	-4.212*	-6.521*	-3.130*
Arithmetic	0.414	-3.04*	0.05
Similarities	3.458*	-0.397	1.5
Pict.Arrang.	-1.181	-3.53*	-1.472
Pict.Compl.	1.494	-2.596**	2.9*
Block Design	-1.319	-4.543*	-2.108**
Object Assem.	-2.179**	-2.193**	-2.057**
Digit Symbol	-6.162*	-6.09*	-6.163*

* Less than 1% probability of being due to chance alone.

** Less than 5% probability of being due to chance alone.

subtests: Digit Span, Digit Symbol and Object Assembly. The Arithmetic and the Picture Arrangement subtests agreed in each pattern but showed no significant deviations. There were no positive significant deviating subtests in the Diers and Brown pattern. Unlike their results, we have found no statistical significance for the subtests of Block Design and Picture Completion, but our subtests of Information, Comprehension and Similarities were found statistically significant at the one percent level. There was agreement in five subtests.

We shall now compare our pattern obtained by the mean Information subtest score taken as point of reference to that of Diers and Brown. The most obvious resemblance in both these results is the fact that all the significantly deviating subtests are negative. There is agreement in the levels of probability in the following subtests: Digit Span, Digit Symbol and Object Assembly. They show significance in the Picture Completion subtest at the one percent level while we show significance of these subtests in the reverse order. Moreover, we find the subtests of Arithmetic and of Picture Arrangement significant at the one percent level while Diers and Brown's pattern does not show any statistical significance for these.

It is evident that the subtests of Digit Span and Digit Symbol agree in all patterns with regards to their statistical significance, their negative deviations and their one percent level of probability.

Our use of Wechsler's method prevented a total agreement in all the patterns for the Object Assembly with regard to its sign and to its level of significance.

There are more disagreements in the five patterns than agreements between subtests. It may be repeated that the pattern acquired with the use of the Information subtest score has been found to be less practical than the pattern obtained when the mean of subtests was used as reference point. This means that there is now fifty percent agreement between Diers and Brown and our own pattern obtained by the mean of subtests.

Those factors contributing to discrepancies are beyond the scope of this study. The two multiple sclerosis populations were different in sex, age range and socialization. Diers & Brown described their group as "this group of patients with multiple sclerosis at the Veterans Administration Hospital[4]".

Turning from the quantitative aspect of testing, the following characteristics of our group as a whole were noted.

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4 Ibid., p. 760.

Nearly every patient complained either directly or indirectly of memory defects. When they attempted to answer the Information questions, most patients said, "Oh, I knew it, but I can't remember". They persisted in an effort to recall a correct answer which they had known in the past and had since forgotten, this persistent effort was only terminated when the psychotechnician went on to the next question.

In the Performance tests their tenacity to solve the problems presented was characteristic. Their manner of working may be described as slow, steady and sure. In the easy problems as well as in the difficult ones their rate of speed was constant. They seemed to concentrate deeply and nothing seemed to distract their attention easily.

In applying Wechsler's and Allen's methods of "sign", we have established a common pattern for our multiple sclerosis population. When computing the statistical significance of the deviating subtests we checked by means of the critical ratio "t" and found Wechsler's technique to be more acceptable than Allen's.

A check for the usefulness of the multiple sclerosis pattern was made to compare individual patterns with the general pattern. Here again Wechsler's method proved to be slightly superior.

When our pattern was compared to that of Diers and Brown fifty percent agreement between subtests resulted.

The individual patterns when compared with the general pattern showed a result of fifty-six percent of multiple sclerotic "signs" appearing in Wechsler's technique as against fifty-three appearing in Allen's.

Now that we have established a pattern for multiple sclerotics, it is interesting to compare the pattern for our group with patterns for groups suffering from organic pathological conditions of the brain.

CHAPTER IV

COMPARISON WITH ORGANIC PATTERNS

In the last ten years much attention has been given to the study of the performance of organic brain pathology patients by means of the Wechsler-Bellevue Scale. Since our second hypothesis assumes that multiple sclerosis patients will behave similarly to organic brain damage individuals, a comparison of patterns for these two groups is now indicated.

To attain this end our pattern is compared with some investigations carried out with the Wechsler-Bellevue Scale. Among others, Wechsler, Allen and Hewson have studied the performance of organics with their respective methods and the results of the first two are compared with our data.

1. Comparison with Wechsler's Organic Pattern.

First, our multiple sclerotic pattern is compared with Wechsler's organic pattern. In order to facilitate the comparison of the sclerotics to Wechsler's organic pattern, it is necessary to convert all the subtest scores into "signs".

Table XV presents Wechsler's organic pattern and our multiple sclerotic pattern as obtained with Wechsler's method in terms of "signs".

TABLE XV.-

Wechsler's Organic Brain Diseased Pattern Compared to Mattar's Multiple Sclerotic Pattern Found by means of Wechsler's Method.

Subtests	Organic "Signs"	Sclerotic "Signs"	Agreement or disagreement*
Information	+	+	+
Comprehension	+	+	+
Arithmetic	-	0	-
Digit Span	--	-	-
Similarities	-	+	-
Picture Arrangement	0	0	+
Picture Completion	0	0	+
Block Design	-- to 0	0	+
Object Assembly	0 to --	0	+
Digit Symbol	--	-	-
Verbal Greater than Performance Score	+	0	-

* Agreement indicated by " + ".
Disagreement indicated by " - ".

The column at the extreme right of the table indicates either agreement or disagreement between the "signs" for each corresponding subtest in the two patterns considered.

Comparison of the results shows that there is agreement in six out of eleven possible comparisons. The subtests in agreements are as follows: Information, Comprehension, Picture Arrangement, Picture Completion, Object Assembly, Block Design. It is worth noting that the amount of deviation in the subtest for Digit Span and in the subtest for Digit Symbol is more pronounced in Wechsler's pattern than in our pattern. Only Similarities, Arithmetic and Verbal greater than Performance Score show complete disagreement.

A partial explanation for the discrepancy in the two patterns may be accounted for by the fact that our population included only mild and moderate cases of multiple sclerosis. This may suggest that a severely impaired sclerotic population might give a pattern similar to that of the organics.

Table XVI presents the frequency and the percentage of Wechsler's organic "signs" found in the sixteen individual multiple sclerosis patterns. Their daily duties are shown as being light "L" or ordinary "Or". Light duty was considered

TABLE XVI.-

The Frequency and Percentage of Organic Wechsler "Signs" Found in Each Individual Multiple Sclerotic Patterns.

Cases	Frequency of Organic Wechsler "signs"		Occupation
	N	%	
1	5	46	L
2	7	64	Or
3	5	46	L
4	7	64	L
5	8	73	Or
6	6	55	Or
7	6	55	Or
8	7	64	Or
9	8	73	Or
10	5	46	L
11	4	36	L
12	5	46	Or
13	6	55	Or
14	4	36	L
15	8	73	Or
16	6	55	L
Total	97		

to be limited work of a sedentary nature, e.g. limited routine clerical duties. Ordinary duty was considered to be any work usually performed by an individual with no physical handicap. The sixteen cases gave ninety-seven organic "signs" out of a possible of 176, thus giving an average of 6.06 "signs" per capita or fifty-five percent of the organic "signs".

When looking for an explanation for the variability in the number of organic "signs" in each individual, the investigator assumed that variability was dependent on the amount of physical energy spent in the occupation of the individual. When 5.9 is used as a critical point for separation, nine cases, with the exception of case number twelve who did an ordinary day's work, returned a greater number of "signs". Seven cases, with the exception of two who performed light work, gave a smaller number of "signs". Despite a lack of statistical proof, it appears that deviation in these three cases may be due to chance fluctuation.

Diers and Brown[1] also calculated the frequency of appearance of organic "signs" in the Wechsler-Bellevue

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1 W.C. Diers and C.C. Brown, Psychometric Patterns Associated With Multiple Sclerosis; Wechsler-Bellevue Patterns, in Archives of Neurology and Psychiatry, Vol 63, No. 5, issue of May 1950, p. 764.

subtests. In Table XVII their results and ours are presented in frequencies and are compared in percentages. The comparison reveals that the following subtests agreed more or less closely for these two studies: Block Design, Picture Arrangement, Digit Symbol and Similarities. On the whole there is little similarity in results and this may be partially explained by the fact that the samples of each study may be different with respect to the degree of impairment in the two multiple sclerosis groups. Our sample was more heterogeneous than that of Diers and Brown which was made up entirely of male veterans.

2. Comparison with Allen's Organic Pattern.

In order to establish a basis of comparison between our multiple sclerotic group and Allen's organic brain disease group, it is necessary to convert all the subtest scores into "signs".

Table XVIII presents Allen's organic pattern and our multiple sclerotic pattern as obtained with Wechsler's method in terms of "signs". Deviations are determined on the basis of Information subtest score of 11.0. The column at the extreme right of the table indicates either agreement or disagreement between the "signs" for each corresponding subtest in the two patterns considered.

TABLE XVII.-

Frequencies and Percentages of appearance of Organic "Signs" in Wechsler-Bellevue Subtests Obtained by Diers and Brown, and Mattar.

Subtests	Mattar		Diers & Brown	
	N	%	N	%
Block Design	13	81.2	17	85
Comprehension	12	75	7	35
Object Assembly	11	68.7	18	90
Information	11	68.7	6	30
Pict. Arrangement	9	56.2	10	50
Pict. Completion	9	56.2		
Digit Symbol	8	50	10	50
Arithmetic	7	43.7	1	5
Digit Span	6	37.5	10	50
Verbal Performance[1]	5	31.2	12	60
Similarities	1	6.2	1	5

1 Sum of Verbal Subtest greater than sum of Performance Subtests.

TABLE XVIII.-

The Relationship Between Organic "Signs" in Allen's Organic Brain Disease Clinical Group and Sclerotic "Signs" in Mattar's Multiple Sclerosis Group.

Subtests	Organic "Signs"	Sclerotic "Signs"	Agreement or Disagreement*
Comprehension	+	0	-
Arithmetic	0	--	-
Digit Span	--	--	+
Similarities	0	0	+
Pict.Arrangement	-	--	+
Pict. Completion	0	-	-
Block Design	-	-	+
Object Assembly	-	--	+
Digit Symbol	-	--	+
Verbal greater than Performance Score	+	0	-

* Agreement in "sign" indicated by "+".

Disagreement in "sign" indicated by "-".

An inspection of the results shows that there is agreement in six of ten possible comparisons. The subtests in agreement are as follows: Digit Span, Similarities, Picture Arrangement, Block Design, Object Assembly and Digit Symbol. Disagreement in subtests may be due to the difference between the two populations.

Table XIX, presents the frequency and the percentage of Allen's organic "signs" found in the sixteen individual multiple sclerosis patterns as shown in Table XII. The sixteen cases gave eighty-one organic "signs" out of a possible 160, thus giving an average of 5.06 "signs" per capita or fifty-one percent of the organic "signs".

Variability is due to differences of occupation as indicated earlier in this chapter. Judging from the data contained in Table XIX, nine cases except for case number eight are well classified. In the "light duty" classification three cases out of seven did not produce the expected results. On the whole, twenty-five percent of the sclerotic group did not produce an organic pattern.

In both procedures case number sixteen did not follow the trend of the group, but it must be remembered that this patient had once spent some time in a mental hospital and consequently another factor might have influenced his test results.

TABLE XIX.-

The Frequency and Percentage of Organic Wechsler "Signs" Found in Each Individual Multiple Sclerotic Patterns and the Occupation of Each Patient.

Cases	Frequency of Organic Wechsler "Signs"		Occupation
	N	%	
1	2	18	L
2	7	64	Or
3	6	55	L
4	3	27	L
5	5	46	Or
6	5	46	Or
7	6	55	Or
8	3	27	Or
9	5	46	Or
10	4	36	L
11	4	36	L
12	7	64	Or
13	5	46	Or
14	5	46	L
15	9	82	Or
16	5	46	L
Total	81		

According to these results it appears evident that those multiple sclerosis patients expending the greatest amount of energy in their daily duties perform most closely to organic brain damaged patients in the Wechsler-Bellevue Scale.

3. Application of Hewson's System.

The two previous sections of this chapter discussed the data obtained when the multiple sclerosis group was compared to two different organic patterns. Hewson's system of ratios will now be applied to our data in order to find out the degree of organic disability indicated by the performance of the multiple sclerosis population on the Wechsler-Bellevue.

Table XX presents the computed ratios. The vertical columns include the case numbers and the results of the eight ratios. Hewson has determined empirically the critical points above which the indices were organically significant, except for ratio number seven which is significant below 0.6.

The data shown in Table XX will now be grouped in Table XXI under the following headings: Psychoneurosis, organic, normal and organic borderline. The organic borderline category includes the indices of the normal category which are one unit from the organic category.

The results for the whole group are distributed as

TABLE XX.-

The Diagnostic Indices Obtained by Each of the Sixteen Multiple Sclerosis Patients by Means of Hewson's Eight Ratios.

Cases	Ratios							
	1	2	3	4	5	6	7	8
1	0.7	1.7**	1.6	1.3	2.5	1.0	0.6	2.3
2	1.1	2.3	1.6	1.4	3.3	1.0	0.8	3.0*
3	1.4*	2.0	1.9*	1.2	3.7*	0.9	0.7	3.9*
4	1.5*	3.1*	1.8*	1.3	3.7*	1.0	0.5*	3.7*
5	1.2	2.9	2.1*	1.4	2.9	1.2*	0.5*	2.6
6	1.6*	5.0*	1.8*	1.8*	4.0*	1.2*	0.7	3.4*
7	0.9	2.6	1.4	1.7*	3.3	1.0	0.8	2.5
8	2.0*	3.6*	1.7*	1.5	4.2*	1.0	0.7	3.8*
9	1.4*	2.9	1.9*	1.5	3.7*	1.0	0.7	3.4*
10	0.9	2.8	1.3	1.6*	2.8	1.0	0.8	2.4
11	0.8	2.0	1.6	1.3	2.6	1.0	0.6	2.1
12	0.8	1.5**	1.0	1.1	2.0	0.7	1.3**	1.9
13	2.8*	5.0*	3.3*	1.5	10.0*	1.2*	0.4*	11.5*
14	3.7*	8.0*	2.0*	1.3	4.0*	1.0	0.3*	4.5*
15	0.8	1.8	2.3*	2.3*	5.4*	1.4*	0.6	4.0*
16	1.2	1.7**	1.6	1.6*	5.3*	1.0	0.8	4.0*

**: Psychoneurotic "sign"
*: Organic "signs"

TABLE XXI.-

Summary of Diagnostic "Signs" according to Category of the Sixteen Multiple Sclerosis Patients on Eight Hewson Ratios. (Sequel to Table XX).

	Ratios								
	1	2	3	4	5	6	7	8	Total
Psychoneurosis	0	3	0	0	0	0	1	0	4
Normal	9	7	7	11	7	12	11	6	70
Organic	7	6	9	5	9	4	4	10	54
Organic Borderline[1]	2	2	4	3	0	10	3	0	24

1 Any "normal" index within one unit of the Organic category.

follows: Three percent psychoneurotics, fifty-five percent normals and forty-two percent organics in the eight ratios. Nineteen percent of the group or thirty-four percent of normals constitute the organic borderline category. Hewson obtained an even one-third distribution for each classification. It was noticed that she did not describe her multiple sclerosis population.

Ratios three, five and eight were those that included the greatest number of organic "signs" for the group. Assuming that our multiple sclerotics were organics in their performance, it is noticed that ratios one and six are poor in diagnosing multiple sclerotic performance on the Wechsler-Bellevue as organic.

The values of ratios two, four and seven appear to be doubtful for diagnosing the organic tendencies in our multiple sclerosis patients.

In Hewson's pattern of multiple sclerotics the organic "signs" came out more often in ratios three, four, five and eight. Only ratio four did not agree with our findings. Instead of ratio four it is noticed that there are ten organic borderline indices and four organic indices, thus indicating a strong tendency in ratio six to diagnose organic pathology.

Table XXII shows that out of sixteen multiple sclerotics, thirteen obtained an organic "J" which is

TABLE XXII.-

Hewson's Summary Diagnostic Judgment (J) for Each of the Sixteen Multiple Sclerosis Patients.

Cases	"J"	Remarks
1	Normal	
2	Organic	Due to poor systematic condition associated with fatigue, etc.
3	Organic	
4	Organic	
5	Organic	
6	Organic	
7	Organic	
8	Organic	
9	Organic	
10	Normal	
11	Normal	
12	Organic	Some anxiety trends.
13	Organic	
14	Organic	
15	Organic	
16	Organic	

indicative of cerebral pathology, either structural or physiological in intellectual functioning. According to rules mentioned in Chapter II, cases number two and twelve were found doubtful because of a poor systematic condition associated with fatigue that could have been present in case two, while case twelve had probably some influencing anxiety trends. These two remarks shown in Table XXII are in complete agreement with our qualitative observations and their case history. Case number two had complained of fatigue to a member of the executive of the Multiple Sclerosis Society. Case number twelve was the least eager and cooperative of the group to be subjected to the test.

An explanation of cases 1, 10 and 11 which obtained a normal "J", follows. Two of three female patients were married and could each afford a servant to help in the household duties thereby obtaining much rest. The other patient helped very little at home as her mother assumed all household duties. This patient could, therefore, also rest in the afternoons. Referring back to Tables XVI and XIX, it is not surprising to find that these cases are among those showing the least number of organic "signs". It may therefore be assumed that the presence of physical fatigue may be the most contributing factor towards making multiple sclerotics perform similarly to organic brain damage patients.

From the results of these three methods we have found that Hewson's was the one which appeared to give the strongest support to our second hypothesis since it diagnosed eighty-one percent of the multiple sclerotic sample as performing similarly to organic brain damage patients.

This chapter has endeavoured to compare the performance of multiple sclerotic patients with organic brain damage patients. In comparing our pattern with Wechsler's organic pattern it is found that six subtests out of a possible eleven agree. Fifty-five percent of organic "signs" appear on the individual patterns of the sclerotics. Similarly, a comparison with Allen's modified organic pattern shows five subtests out of a possible ten coinciding, and fifty-one percent of organic "signs" appear in the individual patterns.

We have included in this study the data of Diers and Brown with multiple sclerotics and the results show slight agreement.

Hewson's ratios have been used for our sample and our data compared with hers in respect of thirteen multiple sclerotics. This method appears to be the best. Eighty-one percent of our multiple sclerotics performed similarly to organic brain damage patients.

An interpretation of the results indicates that the amount of organic "signs" varies in proportion to the expenditure of physical energy.

CHAPTER V

MENTAL DETERIORATION OF SCLEROTICS

In Chapter III a psychometric pattern was established for our multiple sclerosis patients. This pattern was compared in the following chapter to some patterns of the organic brain damage patients. As a logical follow-up we will endeavour to test the third hypothesis which claims that multiple sclerotics show significant degrees of mental deterioration in the Wechsler-Bellevue.

In order to test the third hypothesis two purely quantitative procedures are selected to determine the degree of mental deterioration of our sample.

The methods used are Wechsler's Mental Deterioration Index[1] and Allen's Mental Deterioration Index[2]. Their formulae are applied to our population and the data obtained is presented in Table XXIII.

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1 David Wechsler, The Measurement of Adult Intelligence, Baltimore, The Williams & Wilkins Co., 1944, p. 64-66.

2 R.M. Allen, A Note on the Use of the Wechsler-Bellevue Scale Mental Deterioration Index with Brain Injured Patients, in Journal of Clinical Psychology, Vol. 4, No. 1, issue of January 1948, p. 88.

TABLE XXIII.-

Percentage and Classification of the Wechsler and Allen Mental Deterioration Indices in a Group of Sixteen Multiple Sclerotic Patients.

Cases	Wechsler's M.D.I.		Allen's M.D.I.	
	%	Classification	%	Classification
1	7.3	No deter.	28	Def. deter.
2	27	Def. deter.	38	Def. deter.
3	29	Def. deter.	43	Def. deter.
4	30	Def. deter.	40	Def. deter.
5	26	Def. deter.	48	Def. deter.
6	42	Def. deter.	40	Def. deter.
7	14	Poss. deter.	23	Def. deter.
8	33	Def. deter.	36	Def. deter.
9	15	Poss. deter.	45	Def. deter.
10	13	Poss. deter.	24	Def. deter.
11	9	No deter.	31	Def. deter.
12	-21	No deter.	5	No deter.
13	32	Def. deter.	44	Def. deter.
14	36	Def. deter.	39	Def. deter.
15	10	No deter.	50	Def. deter.
16	3	No deter.	26	Def. deter.

In the accumulation of the data, allowances are made in each procedure for the normal decline with age when using Wechsler's conclusions[3]. For the sake of convenience in comparing the mental deterioration data from both methods, Table XXIII includes the mental deterioration indices for each of the sixteen cases on a percentage basis.

Of the thirty-two ratios obtained thirty-one cases show some deterioration. Only number twelve was the exception to the rule when using Wechsler's formula. This patient was previously mentioned as having some anxiety during the testing situation.

Table XXIII shows that the range for positive indices with Wechsler's formula was from forty-two to a low of three percent, while the range for positive Allen indices was from forty-eight to a low of five percent.

A summary and classification of this data is contained in Table XXIV. The data is classified and changed in percentages to form the following three groups: No mental deterioration (- 10); Possible mental deterioration (11 -20); and Definite mental deterioration (21 +)[4].

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3 David Wechsler, op. cit., p. 66

4 Ibid., p. 66

TABLE XXIV.-

Distribution of Sixteen Multiple Sclerotics in the Wechsler and Allen Mental Deterioration Indices Categories.

	Wechsler's M.D.I.		Allen's M.D.I.	
	N	%	N	%
No Deterioration	5	31	1	5
Possible Deterioration	3	19	0	0
Definite Deterioration	8	50	15	94

According to Wechsler's method five cases or thirty-one percent of the group showed no mental deterioration and three cases or nineteen percent of the group showed possible mental deterioration, while the remaining eight cases or fifty percent of the group showed definite mental deterioration.

According to Allen's method only one case showed no mental deterioration, while the fifteen others showed definite mental deterioration or ninety-four percent of the group.

Wechsler's and Allen's methods when applied to our group agreed inasmuch as they both showed signs of mental impairment resulting from the disease. However, Table XXIV shows that there is not complete agreement within categories. The difference in detection established by the use of these two methods may result from a difference in the two methods of enquiry when mental loss was calculated. It appears, therefore, that further statistical checks are unnecessary and the third hypothesis may be accepted.

CONCLUSIONS

The study of the performance of multiple sclerosis patients on the Wechsler-Bellevue was based on three hypotheses viz. (a) Multiple sclerosis patients have a common pattern on the Wechsler-Bellevue Scale; (b) the pattern obtained by multiple sclerosis patients resembles the pattern obtained by individuals who have organic brain pathology; and (c) multiple sclerotics show a significant degree of mental deterioration. Conclusions and suggestions for further research follow.

Wechsler's method of obtaining the mean score of the ten subtests was used in determining the following pattern: Digit Span and Digit Symbol show negative deviation and the subtests of Information, Comprehension and Similarities show positive deviation. The remaining subtests do not fluctuate. Statistical procedures were used to check significance at the 1% level of the deviating subtests and agreement was reached in the following subtests: Digit Span, Digit Symbol, Information, Comprehension and Similarities. Wechsler's method as applied to our group, when compared with the multiple sclerosis pattern of Diers and Brown, agreed in five subtests.

Allen's modified Information scatter pattern was used in an attempt to establish a pattern for our group but

was not considered to be of the same efficiency as the Wechsler method.

As only 81% of our group obtained half the multiple sclerosis "signs", our first hypothesis must be accepted with a degree of caution.

Wechsler's organic pattern, when compared with our multiple sclerosis pattern, agreed in six of eleven possible comparisons as follows: Information, Comprehension, Picture Arrangement, Picture Completion, Object Assembly and Block Design. The results on subtests of Digit Span and Digit Symbol did not deviate enough to be considered organically significant. Fifty-five percent of Wechsler's organic "signs" were found in the sixteen individual multiple sclerosis patterns.

Allen's organic pattern, when compared with our multiple sclerosis pattern, agreed in six of ten possible comparisons as follows: Digit Span, Similarities, Picture Arrangement, Block Design, Object Assembly and Digit Symbol. Fifty-one percent of Allen's organic "signs" were found in the sixteen individual multiple sclerosis patterns.

Hewson's system of ratios has been used for our sample and our data compared with hers in respect of thirteen multiple sclerosis patients. This method diagnosed eighty-one percent of our population as performing

similarly to organic brain damage patients.

An interpretation of the results of the second hypothesis indicates that the number of organic brain disease "signs" varies in proportion to the expenditure of physical energy.

When Wechsler's Mental Deterioration Index was applied, half of multiple sclerosis patients showed definite mental deterioration due to their psychopathological condition, while Allen's Index showed that ninety-four percent were in that category. The results indicate that the third hypothesis may be accepted.

These conclusions indicate that multiple sclerosis patients behave similarly to organic brain disease patients when subjected to the Wechsler-Bellevue Scale. It is suggested that investigations should be carried further in order to determine if expenditure of physical energy might be a pertinent factor in the diagnosis of organic brain disease patients.

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The author suggested and applied changes in Wechsler's Mental Deterioration Index. These changes were applied to our study.

--------, The Test Performance of the Brain Diseased, in Journal of Clinical Psychology, Vol. 4, No. 3, issue of July 1948, p. 281-284.

A group of 36 encephalopathic veterans were given the Wechsler-Bellevue. Allen's organic brain disease group pattern was compared with our multiple sclerosis pattern.

---------, The Test Performance of the Brain Injured, in Journal of Clinical Psychology, Vol. 3, No. 3, issue of July 1947, p. 225-230.

Emphasis is placed on the value of using the Vocabulary, Information and Comprehension subtests as basic points for the computation of deviations for pattern analysis, rather than Wechsler's subtests mean. The Information subtest method has been utilized for computing deviating subtests in our study.

Diers, W.C., and C.C. Brown, Psychometric Patterns Associated with Multiple Sclerosis; Wechsler-Bellevue Patterns, in Archives of Neurology and Psychiatry, Vol. 63, No. 5, issue of May 1950, p. 760-765.

A group of twenty-four multiple sclerosis patients were subjected to psychometric evaluation of the Wechsler-Bellevue scale. This was a report that most resembled ours and was therefore used for comparison with ours.

Hewson, Louise A., The Wechsler-Bellevue Scale and the Substitution Test as Aids in Neuropsychiatric Diagnosis, in Journal of Nervous and Mental Diseases, Vol. 109, No. 2, Part 2, issue of February 1949, p. 158-265.

Her study showed how the Wechsler-Bellevue scale could be used to reflect the presence of cerebral pathology and of psychoneurosis in adult patients. She has developed a system of ratios for psychodiagnosis. This system has therefore been relied upon more for its method than for its conclusions.

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The report of this Association covers literature on multiple sclerosis up to 1921.

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Valuable as a reference for the Wechsler-Bellevue Intelligence Scale and test manual, and method of psychodiagnosis. Wechsler's organic pattern used for purposes of comparison.

APPENDIX 1

Case Histories of Multiple Sclerotics

Case 1: Female; Age 44; English; Grade XIII education; eleven year illness; light housekeeping duties; left side slightly paralyzed and slight hand tremor; predominant use of right hand.

Case 2: Female; Age 27; Irish; Bachelor of Arts degree; five year illness; clerical work; no apparent impairment; complained of fatigue after testing situation.

Case 3: Male; Age 33; English-Scottish; Grade XII education; fourteen year illness; sells magazine subscription by telephone; use of cane in walking and slight hand tremor.

Case 4: Female; Age 38; English; Grade VIII education; thirteen year illness; light housekeeping duties; greater tremor in gait than in hands.

Case 5: Male; Age 30; English; three year college education; five year illness; swims every afternoon; greater tremor in gait than in hands.

Case 6: Female; Age 39; English; Grade XII education; twelve year illness; busy housekeeper; some tremor in gait and hands.

Case 7: Female; Age 26; English; two years hospital nursing course; eight year illness; chiropractor's assistant; very slight tremor.

Case 8: Male; Age 30; French; bilingual; Grade VIII; six year illness; handy man around the home; greater paralysis of right leg than right arm; he was subjected to the same test over a year ago.

Case 9: Male; Age 50; English; Grade VIII; twelve year illness; farm helper; partial paralysis of left leg.

Case 10: Female; Age 26; Irish; Grade XII; ten year illness; light housekeeping duties; tremor in gait; slight tremor of hands.

Case 11: Female; Age 41; English; Grade IX; five year illness; light housekeeping duties; difficulty in walking and slight tremor of hands; uncooperative and easily distrubed.

Case 12: Female; age 28; Jewish; Grade XI; ten year illness; clerical work; showed some fatigue and unoooperation at times.

Case 13: Female; Age 56; Irish; Grade VIII; twenty year illness; active occupational theraputic duties in an invalid home; paralyzed legs; talkative person.

Case 14: Female; Age 45; German and Scottish; Grade II; many year ill; light occupational theraputic duties; paralyzed legs; apathetic and uncooperative at times.

Case 15: Male; Age 38; Scottish; Grade XII; thirteen year illness; active occupational theraputic duties; paralyzed legs; slight tremor of hands.

Case 16: Male; Age 49; Irish; Grade VIII; ten year illness; bed-ridden patient; paralysis of legs and slight tremor of hands; patient had once spent time in a mental hospital; he has normal behaviour in invalid home.

APPENDIX 2

AN ABSTRACT OF

A Study of the Performance of Multiple Sclerosis Patients on the Wechsler-Bellevue[1]

The medical profession has long been aware of the possibility of change in the mental activity of multiple sclerosis patients. What is the nature of this change and to what extent does any mental deterioration in multiple sclerosis patients compare with that of organic brain disease patients?

By the use of the Wechsler-Bellevue Scale and method quantitative results of sixteen multiple sclerosis patients were used to establish a psychometric pattern. Comparison of the group pattern with the sixteen individual patterns resulted in fifty-six percent of multiple sclerosis "signs" appearing in the patients' patterns. The group pattern when compared with that of Diers and Brown for multiple sclerosis patients returned a fifty percent agreement between subtests.

The pattern of our group of sixteen patients agreed in six out of eleven possible comparisons with Wechsler's organic pattern.

Allen's organic group was used as a basis for comparison with our group and five out of ten possible subtest comparisons agreed.

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1 M.A. Thesis presented by Jean-Charles Matter, in 1953, to the Faculty of Arts of the University of Ottawa.

Newson's method of ratios when applied to our group of multiple sclerosis patients diagnosed eighty-one percent as "organic". An interpretation of results reveals that the number of organic "signs" varies in proportion to the amount of physical energy expended by each patient.

The application of Wechsler's MDI results in 8 patients showing definite mental deterioration and three patients showing possible deterioration. Allen's MDI was more definite in its findings and shows fifteen out of sixteen patients with definite mental deterioration arising from multiple sclerosis.

This study has established beyond doubt the fact that mental deterioration in multiple sclerosis patients does take place. The nature and extent of the deterioration has not been determined but it is considered that the amount ofenergy expended by a patient in his daily duties may influence the speed of mental deterioration. The study also discloses, by comparison of tests, that mental deterioration of multiple sclerosis patients is similar to that of organic brain disease patients in at least 50% of all patients tested and, in one instance, the percentage of similarity reaches 94%.

F I N I S