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I.Q. Changes in Chronic Schizophrenia

By VERNON HAMILTON

The question of the long-stay mental hospital population has recently received a great deal of attention. Proposals, based on the statistics of mental hospital admissions and discharges over the last few years, the increasing development of day hospitals, out-patient clinics, psychiatric units attached to general hospitals, and community services for the mentally ill within the general framework of new and improved methods of treatment, have led to considerable thought as to how best to reintegrate former mental hospital patients into the community. The process of discharging long-stay patients has, of course, been continuous, but the numbers involved have been comparatively small in the past. A policy of reducing considerably the number of mental hospital beds depends partly on aiming at the highest possible maintenance capacity of discharged patients. For long-stay female patients this would involve, among other aims, the re-training in domestic skills to adequate levels, while in male patients the aim would have to be some form of industrial resettlement. The general aim of increasing the activity and skill level of long-stay mental patients has found its expression in the establishment of industrial workshops. From its early beginnings (Baker, 1956) this form of therapy has developed into the establishment of production workshops or factories both inside and outside the walls of mental hospitals. (Wadsworth, Scott and Tonge, 1958; Early, 1960; Cooper and Early, 1961; Wadsworth *et al* 1961, 1962.)

While the usefulness of these workshops is undisputed, there has been a complete dearth of objective, experimental evidence of the clinical, social and psychological changes they are able to effect in long-stay patients. If the general aim of industrial workshop therapy is to be achieved, it would obviously be useful to demonstrate objectively improvements in those incapacities like general intellectual level, social skills, dexterity, speed of reaction and, of course, clinical state, which may be highly relevant to successful re-entry into the community. A number of studies along these lines have been and are being carried out at Springfield Hospital (Hamilton and Salmon, 1962). The present report attempts to high-light the changes in intelligence that have occurred in association with differential activity programmes for male chronic schizophrenics over periods of 6 months and 2 years.

Intellectual Deficit in Schizophrenia

Any physical discomfort, pain or psychological stress may impair performance on an intelligence test. In the case of neurotic patients it could be demonstrated for example (Desai, 1952) that after 4 weeks' treatment I.Q.s on the Progressive Matrices Test rose significantly compared with I.Q.s on admission. On the question of intellectual deficit in schizophrenic patients, considerable research data are available to support the evidence from clinical psychological assessments made for diagnostic purposes that in schizophrenia there is a drop in intellectual abilities as measured by the standard intelligence tests, and furthermore for the inference that the degree of deterioration may be a function of the length of illness or chronicity (Payne, 1960). The tests used for these findings, however, were not constructed to permit the separate assessments of deterioration of logical, rational thought, slowness of reasoning, motor retardation or persistence, each of which function would make its own contribution to the I.Q. value, nor were the studies designed for a controlled assessment of progressiveness of the deficit. The performance of chronic schizophrenics on intelligence tests would, of course, in addition to the primary illness, also reflect the syndrome of institutional neurosis (Barton, 1959) which is considered to be acting progressively under custodial conditions.

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Foulds (1962, a, b, c) carried out a re-appraisal of the hypothesis of progressive intellectual deterioration in schizophrenia. He found that schizophrenics declined in intelligence no faster than normal or neurotic groups, and that after partialling out age, there were generally no significant negative correlations between length of hospitalization and intelligence level. He suggests instead that the undoubted intellectual deficit of schizophrenia is centred on the period of onset, that progressiveness of deficit, i.e. deterioration, is contra-indicated and that it is to some extent reversible particularly in acute non-paranoid patients. While it is not possible to examine Foulds's argument here in detail, it ought perhaps to be said that there are considerable doubts over the validity of accepting a vocabulary level as a reliable indication of best pre-morbid level as Foulds has done (Yates, 1954). From the point of view of the present study it might also be pointed out that Foulds's findings of the partial reversibility of the intellectual deficit were largely obtained from a low chronicity sample, whereas the changes in I.Q. to be discussed here were largely obtained from medium to high chronicity samples and may thus be seen as complementary to Foulds's findings.

The experiments, summarized by Payne (*op. cit.*), suggest that the disturbance of congruent, reality-relevant thought which is one of the factors in the deterioration of pre-morbid intelligence in schizophrenia, may be related to what has been called over-inclusive thinking and failure in conceptual operations to separate the irrelevant from the relevant in directed thinking. Such deficits are bound to become prominent in tests directed at a person's ability to deduce correct and valid relationships between entities. They may also in part account for the irrational and bizarre associations characteristic of the thought processes of all types of schizophrenia.

The psycho-analytic schools have generally considered schizophrenia to be a regressive illness in which the patient's psycho-social behaviour demonstrates a return to ontogenetically earlier forms of overt and covert behaviour. A logical extension of this general theory with respect to cognitive behaviour has been suggested by Freeman and McGhie (1957) and Freeman, McGhie and Cameron (1957). They have suggested that in terms of a general theory of schizophrenic regression, schizophrenic patients should present forms of perception and thought which according to Piaget's theories of child development (Piaget, 1950, 1951, 1953, 1955) are more commonly found in young children, in whom the conceptual, analytic and integrative processes of perception and thought only gradually develop and internalize.

Innate intellectual potential is a physiological concept and its presence and operation can be inferred and determined only in so far as it has been used in the acquisition of human knowledge and in adapting to the confines of the environment. Thus most intelligence tests make use of culturally determined concepts and thinking operations. A test which capitalizes on inductive, deductive and rational thinking in situations relatively free from social or cultural meaning is said to be more nearly a test of basic reasoning capacity than, for example. a vocabulary test which capitalizes on learning and may thus be a good measure of the best educational or cultural level reached by a person. Good examples of the two types of intelligence tests are Raven's Progressive Matrices and the Mill Hill Vocabulary Test. Both types of test indicate only what degree of intellectual ability is *available* at the time of testing, and I.Q.s thus give an indication of an individual's present adapting capacity in relation to environmental needs. Changes in I.Q. levels obtained can, therefore, be interpreted in terms of changes in intellectual ability *available* to deal with day to day problems of planning, working efficiency, adjustment and adaptation. Thus defined, gains made by long-stay schizophrenic patients on intelligence tests have immediate relevance to the question of their resettlement and reintegration into the productive community.

Changes in Intelligence after 6 Months of Differential Rehabilitation Techniques

In 1960 a long-term investigation was initiated in this hospital into the differential clinical, social and psychological changes in male, chronic, non-paranoid schizophrenic patients occurring (1) as the result of occupational therapy conducted by female therapists on

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modern principles, (2) as the result of industrial work in a workshop and (3) in the absence of any therapeutic programme. Patients were randomly assigned to these three groups, and the assignments were further manipulated until an optimal level of equating between the groups had been achieved. Additional re-matching during later phases of the investigation was made necessary by a variety of events (see below) resulting in reconstituted and smaller Occupational Therapy and Control groups. The groups were also equated for chronicity and age. The full results, published in this Journal (Hamilton and Salmon *op. cit.*), showed that in terms of overall improvements workshop therapy was superior to occupational therapy, and the control conditions.

The changes on the Progressive Matrices and Mill Hill Vocabulary Tests are given in Table I. Only the gains in the Workshop group were significant, while the Occupational Therapy group lost ground on both tests. Table I also shows that fewer patients registered a loss in available intelligence on the two tests in the Workshop group than in the other two groups. While the Control group had the greater average gain in Progressive Matrices I.Q. the greatest incremental scores were found in the Workshop group, just as the consideration of the other 11 measurements carried out on the patients at the same time showed that the Workshop group had registered the greatest degree of all-round improvement.

Two-year Follow-up Study

As a result of the long-term nature of the investigations, it was possible to re-test patients after an interval of two years. In the intervening period industrial sub-contract work had been introduced into the hospital workshop, patients in the occupational therapy department had started to take part in the assembly and packaging of toys, and a number of patients from the three original experimental groups had found paid employment outside the hospital. Under these conditions it was inevitable that the industrial work variable as a rehabilitating agent should cease to be controlled for the original three groups. It became legitimate, therefore, to combine results from all those patients who had not passed through the hospital workshop, as well as to consider changes for the total group of patients involved in the study. (It will be seen that the N.s for the Occupational Therapy and Control groups are larger for the 2-year follow-

Table I

Six-months Follow-up

Test	Group	Test Occasion	Mean I.Q.s	I.Q. Range	Aver. gain in I.Q. Points	Range in gains	"A"-test value	Significance level	Percentage improved or unchanged	N.s
Mill Hill Vocabulary	Workshop	1	83.6	64 – 115	+3.8	−9 – +26	0.242	$p<0.05$	71.4	21
		2	87.4	64 – 115						21
	Occupat. Therapy	1	99.9	83 – 115	−5.0	−22 – +5	—	N.S.	42.9	7
		2	94.9	73 – 112						7
	Control	1	76.0	64 – 89	+2.7	−10 – +31	—	N.S.	50.0	6
		2	78.7	64 – 95						6
Progressive Matrices	Workshop	1	85.7	54 – 125	+8.1	−11 – +43	0.138	$p<0.01$	85.7	21
		2	93.8	62 – 122						21
	Occupat. Therapy	1	95.0	77 – 114	−3.7	−24 – +13	—	N.S.	42.9	7
		2	91.3	73 – 114						7
	Control	1	77.0	61 – 94	+10.8	−4 – +23	—	N.S.	83.3	6
		2	87.8	57 – 116						6

Test occasions 1 and 2 represent the initial and 6-month follow-up test occasions.
The "A" test is a simplified version of the "t" test for correlated samples (Sandler 1955).

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up (Table II) than for the 6-month follow-up. This is not due to random or biased inclusion or exclusion of patients, but to the need in the 6-month experimental study to consider only patients who had not carried out any kind of industrial, assembly or construction work. After 3 months, however, a number of patients were moved for therapeutic reasons to productive work or returned to hospital utility departments. Such patients were inevitably omitted from the comparisons shown in Table I but they were included if still in hospital in the 2-year follow-up. The lower number of Workshop group patients in the 2-year follow-up is due to the discharge of 3 patients.) Dealing with the changes for the total group first, Table II shows that Progressive Matrices I.Q.'s had risen significantly ($p<0.01$) and that Mill Hill Vocabulary I.Q.'s had risen substantially but not significantly.

Table II indicates that I.Q. increments occurred in all sub-groups, and that the most significant changes occurred in the Workshop group. (It is usually preferable to have samples containing approximately equal N.s because a larger sample increases the probability of obtaining a statistically significant result. In the present case such an explanation of the more favourable changes in the Workshop group is contra-indicated by the findings with the combined Occupational Therapy and Control group.) After the initial 6-month follow-up period 5 of the 8 patients in the Control group and 7 of the 10 patients in the Occupational Therapy group took part in industrial work of a variety of types and over varying periods. It would, therefore, seem legitimate to explain the increments in these two groups partly in terms of industrial types of rehabilitation activities. In addition, 6 patients commenced work outside the hospital during the 2-year follow-up period: 3 from the original Workshop, 2 from the

TABLE II

Two-year Follow-up

Test	Group	Test Occasion	Mean I.Q.s	I.Q. Range	Aver. gain in I.Q. Points	Range in gains	"A"-test value	Significance level	Percentage improved or unchanged	N.s
Mill Hill Vocabulary	Workshop	I	83·2	64 – 115	+7·8	−13 – +37	0·154	p<0·01	89	18
		F	91·0	71 – 126						18
	Occupat. Therapy	I	97·0	83 – 115	+3·3	−9 – +19	0·539	N.S.	80	10
		F	100·3	86 – 122						10
	Control	I	83·3	64 – 119	+6·3	−3 – +17	0·216	p<0·02	87·5	8
		F	89·6	71 – 122						8
	O.T. + Control	I	93·2	64 – 119	+3·9	−9 – +19	0·329	N.S.	83·8	18
		F	97·1	71 – 122						18
	Total Group	I	87·8	64 – 119	+5·3	−13 – +37	0·303	N.S. (p<0·10> 0·05)	84·6	36
		F	93·6	71 – 126						
Progressive Matrices	Workshop	I	84·2	56 – 125	+14·8	−5 – +44	0·094	p<0·001	89	18
		F	99·0	57 – 133						18
	Occupat. Therapy	I	95·0	77 – 114	+6·9	−11 – +25	0·286	N.S.	90	10
		F	101·9	81 – 127						10
	Control ..	I	87·8	61 – 122	+16·8	+4 – +44	0·185	p<0·01	100	8
		F	104·6	70 – 140						8
	O.T. + Control	I	93·3	61 – 122	+10·0	−11 – +44	0·207	p<0·05	95	18
		F	103·3	70 – 140						18
	Total Group	I	89·0	56 – 125	+12·1	−11 – +44	0·121	p<0·01	93·5	36
		F	101·8	57 – 144						

Test occasions I and F represent the initial and the 2-year follow-up test occasions.

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original Occupational Therapy group and 1 from the original Control group.

The relationship between changes in intelligence and industrial therapy was further assessed by making a within-Workshop comparison of 2 groups of patients: those who entered the industrial Workshop at the start of the investigation and who stayed there carrying out simple dismantling operations, sharing earnings on a group basis, and those patients who were considered suitable on a number of grounds for industrial sub-contract work supplied by outside industry, with piecework earnings and definite delivery schedules. By definition, these groups were not equated for intelligence or any other variable.

Table III shows the changes in intelligence found in association with placing patients in an even more realistic industrial setting. More significant over-all intellectual gains were found in the group which experienced sub-contract working conditions. The three patients from the Workshop group who found employment outside the Hospital in fact came from this sub-group. Their average gain on the Mill Hill Vocabulary was 8 points, on the Progressive Matrices 29 points, and their average stay in Hospital had been 10 years. (Since the 2-year follow-up was completed and since writing this paper, a further 10 long-term patients have successfully passed through the Sub-contract Workshop.)

The relationship between I.Q. levels found at the beginning of the investigation and amount of gains during the 2-year follow-up period was as follows: with Mill Hill Vocabulary I.Q.s of 100 and below the average gain was 7 points, with I.Q.s of 101 and above the average gain was 1·8 points; with Progressive Matrices I.Q.s of 100 and below the average gain was 17·1 points and with I.Q.s of 101 and above the gain was 10·7 points. The differences in gains were not significant, but the trends consistently indicate higher gains for lower initial I.Q.s. A reverse picture emerged from the correlations between initial level and gains in that a correlation of +0.368 ($p<0.05$) was obtained for the Mill Hill Vocabulary and one of 0·083 (n.s.) for the Progressive Matrices. These contradictory results may well be due to the small number of patients with I.Q.s above 100 and therefore the excessive weight given to scores of below 100.

Conclusions

The results indicate that deterioration of intelligence in chronic schizophrenia may not only be halted but reversed. In addition to the industrial activity variable, a number of other factors must be considered in relation to these changes. For example, practice gains due to familiarity with the testing situation, anxiety reduction, and the communication of interest and positive feelings towards the patients, must have made considerable contributions to the test changes of patients in all groups working under all conditions. But this admission need not invalidate any conclusions about the changes in

Table III

Two-year Follow-up, considering sub-contract variable

Test	Group	Test Occasion	Mean I.Q.s	I.Q. Range	Aver. gain in I.Q. Points	Range in gains	"A"-test value	Significance level	Percentage improved or unchanged	N.s
Mill Hill Vocabulary	Workshop	I	77·2	64 – 115	7·9	−13 – +37	0·395	N.S.	78	9
		F	85·1	71 – 126						
	Workshop + Sub-contract	I	88·9	64 – 106	7·9	+1 – +26	0·233	$p<0·05$	100	9
		F	96·8	87 – 117						
Progressive Matrices	Workshop	I	73·3	56 – 104	12·9	−5 – +29	0·204	$p<0·02$	89	9
		F	86·2	64 – 133						
	Workshop + Sub-contract	I	94·9	64 – 125	15·4	−3 – +44	0·195	$p<0·02$	89	9
		F	110·3	77 – 126						

Test occasions I and F represent the initial and the 2-year follow-up test occasions.

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intelligence or those concerning the role played by industrial therapy. On the contrary, if long-stay, deteriorated patients find it possible to take advantage of re-test situations to increase the level of their measured intelligence, it may be said that they are responding as normal people or neurotic patients would under similar conditions. In other words, the patients were able to adapt both emotionally and cognitively—they were able to learn or perhaps more correctly to re-learn. This learning or re-learning ability has been demonstrated from a number of angles in the present series of studies but especially in association with industrial therapy. It has appeared in rising output curves and in concomitant increases in wages earned, in improvements in manual and finger dexterity, in faster reaction times and in improved social skills. Such changes, if patiently developed, must lead to optimistic though cautious predictions concerning the industrial re-employment of long-stay mental patients under national conditions of full employment.

The comparatively large intellectual changes of the Control group used in these studies, rather than devaluing the role of industrial workshop therapy, suggests the operation of social and psycho-dynamic influences in this as well as the other groups. The patients may have felt that renewed interest was being taken in them and that they were members of a group because of their periodic re-assessments. The sometimes devious and subtle communication system of the patient community additionally spread the knowledge that new methods of treatment were being developed, that they often led to unexpectedly high monetary rewards and to work outside the hospital or even discharge. Under the conditions prevailing in the hospital at the time, the improvements made by members of the Control group were, therefore, not unexpected, since the evidence of progressive intellectual *deterioration* had been obtained from patients who had lived apparently under custodial conditions. On purely statistical grounds, however, the changes that occurred in the non-Workshop groups must be considered with caution because of the small numbers involved and because with small numbers a single case of spontaneous remission may give a false or unreliable picture of group trends.

Sufficiently marked trends are present in the data to point to the important role that may be played by graded and planned industrial therapeutic methods in effecting changes in intelligence. In chronic schizophrenia it is not a question of establishing intellectual levels not previously reached as is the case in mental subnormality (Clarke and Clarke 1953), but rather a question of re-activating, re-establishing and re-directing cognitive functions initially distorted by the pathological processes of deviant and incongruous logical operations, and then overlaid by the secondary symptoms of institutionalization. On the assumption that re-activation by industrial techniques can lead to increases in intelligence potentially up to the best previous intellectual level, it could be predicted that the greatest gains would be made by those with the highest pre-morbid level as well as those with the greatest amount of deterioration. This prediction, however, is difficult to test at present because it is not yet possible to estimate accurately the pre-morbid intelligence level of chronic schizophrenic patients.

The demonstrated changes in measured intelligence show that changes have occurred in the *availability* of rational intellectual processes in male chronic schizophrenics. Since on the whole these changes have been most pronounced in association with industrial therapeutic activities, there is a strong case for linking them with factors which characterize industrial life: socially relevant, useful and accepted work, male, production-centred supervision, time keeping and payments by results. It is possible that these factors combined have a behavioural or even centrally acting arousal effect in chronic schizophrenia. This assumption is at present being submitted to experimental investigation.

Summary

Intelligence changes in male chronic schizophrenic patients undergoing differential therapeutic activity programmes are reported. The study was in two phases. A first 6-month phase in which three equated groups of patients took part in Workshop activity, Occupational Therapy or no special therapeutic programme, and a second

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2-year follow-up period in which the effects of normal industrial sub-contract work was additionally assessed.

The findings indicate that the postulated decline of intelligence in chronic schizophrenia can be halted as well as reversed, particularly when patients are engaged in quasi or real industrial work. The possible reasons for the observed changes in available intellectual capacity are discussed, as well as their implication for community resettlement.

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