THE RELATION BETWEEN THE AGES AND THE INTELLIGENCE OF PATIENTS AT THE ALEXANDRA INSTITUTION

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In a random sample of the normal European population we do not expect to find any significant relationship between the chronological ages of individuals and their IQs. Presumably the most intelligent 20% will have the same average age as the middle 60% or as the dullest 20%. Stated otherwise, the younger generation will have about the same average IQ as the older.

With mental defectives, however, we expect to find some relationship between age and IQ, because we know that idiots have a shorter span of life than morons. Tredgold[1] devotes a chapter to a general discussion of the problem, but no systematic statistical study of it has as yet been recorded, and as accurate information may be of value in research in hospital planning and policy, and as it may add to our knowledge in the field of expectation of life, as well as promote our knowledge of the mentally defective, this work was undertaken to obtain precise data.

The subjects for the investigation were 863 patients on the register of the Alexandra Institution for Mental Defectives, one of the 3 institutions for mental defectives administered by the Union Health Department.

The general method employed was to compute and then to compare with one another the average ages of all the patients falling within increasing step-intervals of IQ from zero upwards, to compare with one another the average IQs computed in respect of different age levels, and to find correlation coefficients.

The age and IQ data were taken as at 31 December 1954. The intelligence of the patients had previously been tested by the writer. Gesell's tables of development[2] were used to assess the lowest mental ages, the Merrill-Palmer scale[3] for mental ages of 18-48 months, the Terman-Merrill scale[4] for mental ages of 6-12 years, and the National Bureau test[5] for 3-12 years. Raven's Progressive Matrices[6] and an unpublished test were used as a non-verbal scale for deaf-mutes with relatively high mental ages, and for other patients with language complications. The IQs can be regarded as reasonably reliable.

Although fractions of a year and of IQ were employed in the original computations, they are omitted in the text in order to make the comparisons more readable and to condense the tables.

Table I reflects the number of patients found in each step-interval of IQ, and their corresponding average

TABLE I. CHRONOLOGICAL AGES IN YEARS OF 863 PATIENTS OPPOSITE INCREASING IQ INTERVALS

IQ	*Number*	*%*	*Average age*	*Median age*	*Standard deviation*
(0—4)	(32	4	15	15	7·2)
0—9	95	11	18	16	9
10—19	103	12	23	20	13·2
20—29	159	18	29	28	15·4
30—39	117	14	32	29	16·5
40—49	146	17	37	37	15·3
50—59	111	13	34	34	14·9
60—69	93	11	35	34	13·3
70+	39	5	31	31	10·9
Total	863	101	30·3	28·2	15·4

chronological ages. There is a convincing relationship between age and IQ; they increase concomitantly up to an optimum IQ of 45 (the mid-point of the step-interval) after which the average falls to a level of 31 years, when an IQ of 70 and higher is reached.

Two major factors operate in this relationship. The higher the IQ, the bigger is the life span, and this positive relationship would have continued above the IQ of 45, if it were not for a limit imposed by a second factor which is a negative one, namely that patients with IQs of about 55 and higher, unlike those with the lower IQs, tend to leave the institution before they reach the higher chronological ages, their withdrawal systematically depressing the average ages of the higher IQ categories. This trend is strongest in our highest IQ group where the spread of the ages as measured by the standard deviation has in consequence shrunk to 10·9 years.

Table II shows the incidence for each chronological age-interval from zero upwards and the corresponding

TABLE II. AVERAGE IQS OF 863 PATIENTS OPPOSITE INCREASING CHRONOLOGICAL AGE INTERVALS

Age		*Number*	*%*	*Average IQ*
0—9	..	62	7	23
10—19	..	200	23	27
20—29	..	202	23	39
30—39	..	162	19	42
40—49	..	138	16	45
50—59	..	72	8	41
60+	..	27	3	44
Total	..	863	99	36·7 (S.D.20·2)

average IQs. The same striking relationship as in the previous table is revealed, the average IQ of patients of 30 years and older being twice that of those who are under 10, and average age and IQ increase concomitantly up to an optimum of 45 years after which the increase in IQ ceases. The drop in the IQ at 55 years is a chance irregularity in the distribution.

The relation so far revealed can be expressed by a single quantity, the correlation coefficient. (If the relation between the 2 variables is perfect, so that the person with the highest IQ is also the oldest, while the one with the next highest IQ is also the next in age and so on for all 863 patients, downwards to the one with the lowest IQ who will then also be the youngest, then the correlation is positive and perfect, and we have a correlation coefficient (r) of 1·00; if there is no relationship between the two variables, then the result is r·00. Between these extremes any values of r can be found). The r for our data, calculated by the product-moment method was found to be ·306 which was much higher than anticipated.

In search of an explanation for such a high correlation we next considered the possibility of the existence of large clinical groups of patients with a very high r between age and IQ, and who are perhaps responsible for the original high relationship. If we could identify such clinical varieties, extract them from the main inmate body and then compute fresh correlation coefficients and tables showing the relationship between age and IQ in respect of the residual group, a lowered r could be expected.

Various clinical varieties were submitted to a preliminary trial, until we arrived at 3 varieties with high age-IQ relationships—the spastics, the epileptics, and the spastic epileptics, the last constituting an overlap of the first 2; they numbered 159, 163 and 62 respectively, making a total of 260 Ss.

Table III reflects the incidence for each IQ step-interval and the corresponding average age, the 3 clinical

TABLE III: AVERAGE AGES OPPOSITE INCREASING IQ-INTERVALS OF 159 SPASTICS, 163 EPILEPTICS, 62 SPASTIC EPILEPTICS AND THE THREE GROUPED

IQs	*Spastics*		*Epileptics*		*Spastic Epileptics*		*Grouped*	
	No.	*Age*	*No.*	*Age*	*No.*	*Age*	*No.*	*Age*
(0—4)	(26	13	18	13	17	13	27	13)
0—9	53	16	42	15	30	14	65	16
10—19	25	16	25	19	11	17	39	18
20—29	30	28	28	26	9	21	49	28
30—39	18	28	15	31	6	26	27	30
40—49	13	36	26	34	6	37	33	34
50—59	20	35	13	34	—	—	33	35
60+	—	—	14	33	—	—	14	33
Total	159		163		62		260	
Ave. age	23		25		19		25·8	
Ave. IQ	24		28		18		29·4	
r Age-IQ	·539		·527		·608		·515	

varieties being treated first separately and finally grouped.

The relationships are considerably higher than those found for the total inmate body (Table I). The average age of the highest IQ levels is 3 times that of the low grade idiots, and each increase in the IQ interval is accompanied by a corresponding increase in average age. These general findings are confirmed by the exceptionally high values for r.

These groups differ from the total inmate body in that there is no drop or levelling out of the average ages when the higher IQs are reached, and therefore, only one factor is required to account for the relationship revealed, namely that the higher the IQ, the bigger is the expectation of life. In consequence of their superimposed handicap the members of these groups do not leave the institution, so that the 2nd factor, earlier invoked, is absent here. The circumstance that for all 3 clinical varieties the final average age and IQ for each group are almost identical is a chance occurrence.

We next calculated in the same manner as before, the average IQs in respect of each clinical variety separately and finally grouped. The data are presented in Table IV.

TABLE IV. AVERAGE IQS OPPOSITE INCREASING AGE-INTERVALS OF 159 SPASTICS, 163 EPILEPTICS, 62 SPASTIC EPILEPTICS AND THE THREE GROUPED

Ages	*Spastics*		*Epileptics*		*Spastic Epileptics*		*Grouped*	
	No.	*IQ*	*No.*	*IQ*	*No.*	*IQ*	*No.*	*IQ*
0—9	29	14	16	11	15	9	30	15
10—19	50	21	57	19	24	9	83	23
20—29	35	28	40	33	14	29	61	31
30—39	25	35	23	36	9	30	39	37
40—49	12	35	16	46	—	—	28	41
50+	8	44	11	42	—	—	18	43
Total	159		163		62		260	

The same relationship as observed under Table III emerges and no special comment is called for—patients who reach the age of 35 have an average IQ 3 times that of children under 10, and the maximum age reached by spastic epileptics is only 39 as against 50+ years for the rest.

The 260 clinical cases were next extracted from the main body of patients and fresh data computed to show

TABLE V. AVERAGE AGES AT INCREASING IQ-INTERVALS OF 603 PATIENTS OPPOSITE EXTRACTED CLINICAL VARIETIES

IQ	*Clinical Groups*			*Residual Group*		
	No.	*% of 260*	*Age*	*No.*	*% of 603*	*Age*
(0—4)	(27	(10)	13	5	(1)	19)
0—9	65	(25)	16	30	(5)	22
10—19	39	(15)	18	65	(11)	26
20—29	49	(19)	28	110	(18)	30
30—39	27	(10)	30	90	(15)	33
40—49	33	(13)	34	108	(18)	37
50—59	33	(13)	35	87	(15)	35
60—69	14	(5)	33	77	(13)	35
70+	—	—	—	36	(6)	31
Total	260			603		
Ave. age	25·8 yrs.			32·3 yrs.		
r Age-IQ	·515			·184		

the age-IQ relationship for the residual of 603 Ss. The data for the 260 subjects and for the 603 are set out alongside each other in Table V, which reflects the average ages corresponding to increasing IQ intervals. The residual group are superior to the special clinical varieties; their average age is higher, relatively fewer of them are in the low-grade idiot category and they reach a higher maximum IQ, 4 times as many being in the IQ category of 60+.

The relationship between age and IQ persists but it has been greatly reduced, the age range of the residual being now 19-37 years as against 15-37 for the original 863 Patients (Table I). The reduced relationship is also reflected in the considerably lowered value of r, which is now ·184.

The average IQs of the residual group were computed and set out against those of the clinical groups but, as no fresh valuable information emerged, they are not tabulated here. The residual had a higher average IQ than the clinical, more of them reaching the highest age levels. The extraction of the clinical group had the effect of reducing the relationship between age and IQ, so that the new average IQ range is 30-45 as against 23-45 (Table II), but the restant relationship remains high.

Attempts at locating other clinical groups for exclusion from the main body in a statistically reliable manner, in order further to reduce our correlation coefficient were unsuccessful.

To facilitate comparisons, Table VI shows the final state of the average ages of the different groupings, their average IQs and the correlation coefficients.

TABLE VI. FINAL AGES, IQS AND CORRELATION COEFFICIENTS

Category	*No.*	*Age*	*IQ*	*r*
Spastic epileptics	62	18·7	18·2	·608
Spastics inclusive of spastics with epilepsy	159	23·4	23·6	·539
Epileptics inclusive of epileptics with spasticity ..	163	25·2	28·2	·527
	163	25·2	28·2	·527
Spastics without epilepsy ..	98	26·4	27·5	·441
Epileptics without spasticity	101	28·7	34·7	·382
Total patients	863	30·3	36·7	·306
Residual after excluding of epileptics	700	31·4	38·7	·239
Residual after excluding of epileptics and spastics ..	603	32·3	40·4	·184

It epitomizes much of the preceding data and calls for no special comment, its most striking feature being the inverse relationship between the correlation coefficients on the one hand, and age and IQ on the other. The hierarchy is almost perfectly regular.

It remains to present a percentage table (Table VI) of the distribution of IQs against an age scale. It has practical value, besides bringing out many of our earlier findings in full relief. Much of the data in Table I is

TABLE VII. PERCENTAGE PATIENTS UNDER THEIR RESPECTIVE IQ INTERVALS LOCATED OPPOSITE EACH AGE RANGE

Ages	*Intelligence Quotients*								
	(0 *to* 4)	0 *to* 9	10 *to* 19	20 *to* 29	30 *to* 39	40 *to* 49	50 *to* 59	60 *to* 69	70 *to* 79
0—9	25	17	14	10	6	1	4	2	3
10—19	53	53	38	22	21	15	14	9	10
20—29	22	18	22	22	26	19	25	28	36
30—39		9	14	20	15	22	22	25	28
40—49		3	8	13	18	21	21	24	23
50—59			4	10	8	16	11	8	
60—69			1	3	3	2	5	3	
70—79					3	2		1	
80—89						1			
No.	(32)	95	103	159	117	146	111	93	39
Ave. age	15	18	23	29	32	37	34	35	31
Med. age	15	16	20	28	29	37	34	34	31

represented in visible and readable form. It is noted that from IQ 40 upwards the distributions are nomal, the average and median ages being identical; below IQ 40 the median ages are smaller than the average ages, the distributions are negatively skewed by an accumulation of cases at their lower ends, The table lends prominence to the paucity of cases in the quadrant bounded by ages

50-89 and IQs 50-79, this being the result of the second factor identified under Table I.

DISCUSSION

Subscribing to the traditional assumption that the coefficient of correlation for chronological age and IQ is ·00 in a random sample of the population, we set out to investigate the position in institutionalized mental defectives, and found what must be a significant discovery, a positive relationship varying from r ·184 to r ·608, the value depending upon the clinical grouping. We cannot concern ourselves here with the theoretical implications of this finding, but its practical value for the management of mental defectives merits brief consideration.

1. The correlation coefficients reveal that, in terms of averages, patients with high IQs also tend to reach high chronological ages, but the discovery of a second factor which operates in the age-IQ relationships shows that high-grade patients do not remain indefinitely in the institution. Table VII shows that they leave mainly from the age of 35-45 years, an age at which it has become difficult for them to throw off attitudes and standards engendered in an institutional environment of mental defectives, to learn a set of new social and ethical standards.

The question may be posed whether it has been the best plan to keep them so long in an institution or even grant them admission in the first instance. The most suitable place for children with IQs 50+ who are unencumbered with superimposed handicaps are the Provincial Education Department's special classes and, failing these, the homes for backward children administered by the Union Education Department. Only when these bodies have cared for such children up to the age of 19 years, at which the provisions of the Children's Act of 1937 cease to apply, only then should they properly be considered for an institution for mental defectives when all else has failed.

Table VII shows that this observation concerns a fair number of patients, and our findings enable us to approach the problem of allocation of hospital accommodation more scientifically by helping them to anticipate and hasten their inevitable departure.

2. Children with IQs 0-4 are very deeply defective and their expectation of life is poor. Our findings (Tables I and III) show that there are 32 in this group, of whom 17 are spastic epileptics; and that in the IQ range of 0-9, there are 95 patients of whom 30 are spastic epileptics, 12 are epileptics only and 23 are spastics only. They—and one could include a fair proportion of the 103 patients in the IQ 10-19 range—seem to constitute a rather distinct clinical group, different from the other patients in their material hospital requirements. It would appear as if a bold, scientifically orientated policy would call for their complete segregation from other mental defectives, in an environment devised and standardized for their specific needs.

3. We now know that all infants have not the same statistical expectation of life. We have found correlation coefficients for age and IQ which range from ·184 to ·608, the value varying with the absence or presence of superimposed specific handicaps. This knowledge, together with the data in Table I, enables us to assess more precisely than hitherto an infant's expectation of life, when backwardness and the degree of it are diagnosed.

SUMMARY

This statistical study aims at making our knowledge of mental defectives more exact by evaluating the relation between their average age and IQ.

The ages of patients in different IQ categories were computed and compared; similarly, average IQs of different age-groups were found and compared. Correlation coefficients were found.

A percentage table showing the age limits within which given percentages of patients with known IQs fall, was compiled.

An unmistakeable relation between age and IQ was found, its extent depending upon the degree of defect and its complications.

The findings have academic and practical value.

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