

MENTAL GROWTH OF NONINSTITUTIONALIZED AND INSTITUTIONALIZED CHILDREN WITH DOWN'S SYNDROME

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INTRODUCTION

Recognition of the advantages of home and community living (Cain & Levine, 1963) has brought gradual changes in referral patterns for children identified early as moderately or severely retarded (Covert *et al*, 1965), and formerly recommended for institutional placement. The work of Rheingold and others (Rheingold, 1956, 1960, 1961, 1973; Rheingold & Bayley, 1959; Rheingold *et al*, 1959) had shown the influence of maternal and environmental stimulation upon infant development. Alternate patterns of care have been developed for residential facilities (Kugel & Wolfensberger, 1969). Currently, "Right to Education" legislation in the United States has extended the range of public support for children previously outside the scope of community school services.

The problem of investigating the mental development of retarded children assumes new dimensions in view of the different environment which these recent innovations provide. In particular, the mental development of children with Down's Syndrome has received further attention in view of the current trends in state legislation in regards to "Right to Education."

PURPOSE

The purpose of this study was to provide a descriptive curve of mental growth for children with Down's Syndrome who were not institutionalized at the time of testing. A further objective of the investigation was to compare this curve in a composite graphic comparison with the curve of mental growth presented for children who were institutionalized. It was hoped that this comparison would contribute further information regarding the mental growth of persons with Down's Syndrome during critical years of development.

REVIEW OF THE LITERATURE

A review of the literature related to the intellectual development of children with Down's Syndrome indicated the advantages of home rearing as opposed to institutionalized care. However, studies presenting mental growth curves for Down's Syndrome children have been limited largely to institutionalized groups.

Among several items contributed by Durling and Benda (1952) regarding the intellectual development of an institutionalized population was the finding that neither positive nor negative effects of earlier or later admission could be observed among patients with a final Stanford-Binet MA under three years. These authors reported further that mental growth curves showed considerable individual variation. Ross (1962) concluded that the curve of mental growth for institutionalized patients with Down's Syndrome was essentially of the same shape as the curve of intellectual development for normal children, but only approximately 25% as high at each corresponding chronological age.

Zeaman and House (1962) described the MA of persons with Down's Syndrome as proportional to $\log CA$. These investigators conducted both cross-sectional and semi-longitudinal analyses of their data. They cautioned that the equation $MA = 18 \log CA$ was an empirical formula that described mental growth among persons with Down's Syndrome over six years of age and should not be extrapolated to younger ages.

Silverstein (1966) contributed to this work when he presented a further integration of the basic Zeaman and House formula. This statement was $MA = 18 \ln CA - .3 CA + c$. In this latter formula, MA was in months, CA was in years, the logarithm was to be base e , and c was a constant set to zero. In this same study, Silverstein (1966) described the mental growth of persons with Down's Syndrome by the equation $MA_{est} = 20.78 \log CA - 5.77$ with MA_{est} and CA in months. Crediting Zeaman and House (1962) with the observation that the ratio $MA/\log CA$ served as a useful measure of intelligence for this population, Silverstein (1966) developed the MQ defined as $100 MA/MA_{est}$ and found this measure to have greater stability than the traditional measures of intelligence. The Zeaman and House $18 \log CA$ equation, the Silverstein $18 \ln CA - .3 CA$ modification, and the MA_{est} Silverstein formula all predict similar mental growth over seven years of age. The $18 \ln CA - .3 CA$ plot differs considerably from the other two equations below this age. Some of the literature indicated that perhaps none of the equations predicted mental growth for the noninstitutionalized population adequately.

In an investigation of the upper ranges of intelligence among children with Down's Syndrome, Dunsdon *et al.* (1960) estimated the upper limit of Stanford-Binet IQs to be in the region of 70. They estimated that 6% to 7% of their sample had IQs of 45 or above. Share *et al.* (1964) reported longitudinal data from a predominantly home-reared group of Down's Syndrome children which indicated steady developmental progress. In addition to higher intelligence quotients and higher social quotients, Stedman and Eichorn (1964) found significant developmental advantages among home-reared children ranging in age from 17 months to 36 months. Shotwell and Shipe (1964) found that Down's Syndrome children reared at home for at least the first two years of life were intellectually and socially superior to children institutionalized at birth. These investigators found evidence of this superiority three years after the home-reared children were placed in institutions (Shipe & Shotwell, 1965).

Barclay and Goulet (1965) found that absolute increments in MA and social age were offset by faster rates of CA increments among retarded, noninstitutionalized children resulting in an earlier attainment of asymptotic levels of intellectual development. Barclay (1969) reported indications that the curve of intellectual development among noninstitutionalized retarded children is similar to, but slower than, the usual monotonic curve reported for normal children. Cornwell and Birch (1969) reported that the IQ scores of their home-reared children with Down's Syndrome decreased with age, but that social quotients did not decline as systematically.

The literature of the 50's, 60's and early 70's indicated the intellectual and social superiority of Down's Syndrome children who had been reared at home. This information suggested that a curve describing the mental growth of children who were not placed in institutions might differ from the mental growth curves presented for institutionalized children with Down's Syndrome. The present study plotted a mental growth curve for noninstitutionalized children under 16 years of age, and compared this with mathematically described curves presented by Zeaman and House (1962) and by Silverstein (1966).

METHOD

Subjects

Data for the present study were obtained from measures of mental development administered to 245 children ranging in age from one year to 16 years of age with diagnosed Down's Syndrome. One hundred and thirty of the children were boys, and a hundred and fifteen were girls. This sample was comprised of one hundred and seventy-seven children evaluated at a pediatric diagnostic clinic and 68 children attending a private residential school for exceptional children. Children seen at the clinic ranged in age from one year to 16 years. The children enrolled in the residential school programs were tested between four and 12 years of age. School admission criteria required that these children be ambulatory, possess basic self-help skills, and be free of serious medical or emotional problems. All of the school children returned to their homes each weekend and for school vacation periods. None of the children included in the study were institutionalized at the time of testing.

PROCEDURE

The measure of mental growth operationalized for the purpose of this study was the mental age derived from the Cattell Infant Intelligence Scale (CIIS) and the Stanford-Binet, Form L-M. Prior to age two years, all MAs reported were obtained from administrations of the CIIS since this instrument provides an extension of the Stanford-Binet to younger ages (Cattell, 1940). Either the CIIS or the Stanford-Binet was administered to children between two and nine years of age depending upon the examiner's judgement in the selection of instruments. All MAs reported for children 10 years of age or over represent results obtained from administrations of the Stanford-Binet. The majority of the children were tested twice, and many had a third test. The total number of test administrations was 378.

Table 1
AVERAGE MA SCORES BY CA INTERVAL
(Number of Tests = 378)

<i>CA Interval</i>	<i>Mid-point</i>	<i>No. of tests</i>	<i>MA Score</i>
12 — 23	17.5	13	7.46
24 — 35	29.5	24	14.21
36 — 47	41.5	44	19.10
48 — 59	53.5	47	21.81
60 — 71	65.5	68	28.60
72 — 83	77.5	53	33.36
84 — 95	89.5	29	36.55
96 — 107	101.5	38	37.82
108 — 119	113.5	12	33.92
120 — 131	125.5	22	48.45
132 — 143	137.5	6	46.83
144 — 155	149.5	8	54.13
156 — 167	161.5	6	54.33
168 — 179	173.5	3	60.00
180 — 191	185.5	5	64.60

Note: CA intervals, midpoints and MA scores given in months.

The MAs obtained from these test administrations were averaged for children tested during the same CA interval. In one instance, two test results for the same child were reported in the same CA interval. Intervals of 12 months were chosen, and the average MA of children tested during each CA interval was assigned to the respective midpoints of consecutive intervals. The CA intervals in months were: 12-23, 24-35, 36-47, 48-59, 60-71, 72-83, 84-95, 96-107, 108-119, 120-131, 132-143, 144-155, 156-167, 168-179, and 180-191. Table 1 presents the number of test administrations and the average MAs for children within each CA interval.

The average MAs obtained from repeated administrations of the Cattell Infant Intelligence Scale and the Stanford-Binet provided information regarding the mental growth of noninstitutionalized children with Down's Syndrome under 16 years of age. It is to be noted, however, that the number of test administrations in the upper CA intervals is small.

In an attempt to present this information graphically, these data were smoothed following the procedure of successive averaging described by McNemar (1962). This procedure was employed twice. MAs corresponding to the CA interval midpoints were calculated from the $MA = 18 \log CA$ formula presented by Zeaman and House (1962), and for both the $MA = 18 \ln CA - .3 CA$ and the $MA_{est} = 20.78 \log CA - 5.77$ formulae presented by Silverstein (1966). While these computations were performed in the course of this study, it should be kept in mind that these authors cautioned against the extrapolation of these formulae to CAs below six years. Discussion of the graphic comparisons produced was restricted to CAs over 72 months. Table 2 provides a comparison of the smoothed data of the present investigation with MAs derived from the formulae presented in the literature.

Table 2
Smoothed MA Scores and Calculated MA Values

<i>CA Interval Midpoint</i>	<i>Smoothed Scores</i>	<i>18 log CA^a Scores</i>	<i>20.78 log CA - 5.77^b Scores</i>	<i>18 ln CA - .3CA^c Scores</i>
17.5	7.46	22.37	20.06	6.85
29.5	13.14	26.46	24.77	15.74
41.5	18.38	29.14	27.84	21.05
53.5	23.15	31.10	30.15	25.72
65.5	27.98	32.69	31.97	29.04
77.5	32.22	34.00	33.48	31.74
89.5	34.95	35.13	34.77	34.02
101.5	37.36	36.11	35.92	35.97
113.5	39.74	36.99	36.93	37.67
125.5	44.27	37.78	37.84	39.15
137.5	48.16	38.48	38.66	40.50
149.5	52.53	39.15	39.43	41.70
161.5	55.85	39.74	40.11	42.80
173.5	59.36	40.30	40.76	43.11
185.5	60.47	40.83	41.37	44.70

Note: CA interval mid-points and MA scores given in months.

^aZeaman and House (1962).

^bSilverstein (1966)

^cSilverstein (1966). MAs based upon CA mid-points in years.

RESULTS

Plotting the smoothed data from the present study against the midpoints of the CA intervals yielded a descriptive mental growth curve for noninstitutionalized children with Down's Syndrome under 16 years of age. Superimposing the curves described by the mathematical formulae presented by Zeaman and House (1962) and by Silverstein (1966) provided some opportunity for comparison of mental growth curves.

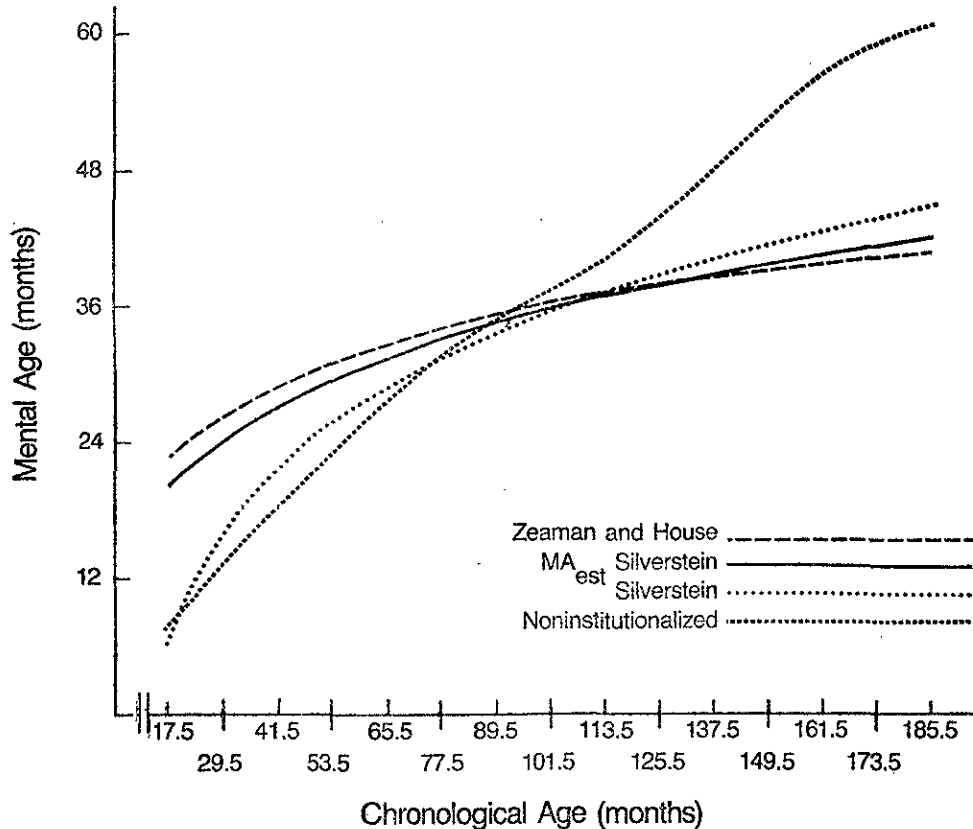


Figure 1. Composite graph of mental growth curves for children with Down's Syndrome.

The mental growth curve described by the smoothed data collected in the present investigation varies noticeably from the mathematically described curves above the nine year CA interval. The curve for the noninstitutionalized children begins lower than the curves for those who were institutionalized, and ascends to a higher level by age 16 years. From an average MA of 7.46 months at CA 17.5 months, the curve describing the noninstitutionalized children rises to intersect the curve presented by Silverstein (1966) within the 84-95 month CA interval at an MA of almost 35 months, and intersects the curve presented by Zeaman and House (1962) within the 96-107 month CA interval at an MA of approximately 36 months. The curve drawn for the noninstitutionalized children continues to rise and reaches an MA of approximately 60 months within the 180-191 month CA interval, reflecting a departure of more than 18 months in MA from the other curves at this point.

DISCUSSION

Limitations of the Study

Data for the present study were gathered from children evaluated at a diagnostic clinic and from children attending a residential facility with day-school programs. These data were combined in an effort to examine all of the information available to the investigators regarding children with Down's Syndrome who were not institutionalized at the time of testing. However, it must be acknowledged that selective factors related to schooling, such as the admission criteria mentioned and continued schooling for some of the older children may have biased the data collected. With regard to this observation, it should be noted that only 28 of the total 378 test administrations were available for children from 11 through 15 years of age. These considerations limit generalizability of the present study, and require caution in the interpretation of these data.

SUMMARY

The purpose of this study was to present a descriptive mental growth curve for noninstitutionalized children with Down's Syndrome. This curve was presented in a graphic composite with those published in the literature. Zeaman and House (1962), and Silverstein (1966) pointed out that their respective formulae were suspect for extrapolation to children under six years of age, but the formula $18 \text{ In CA} - .3 \text{ CA}$ (Silverstein, 1966) approximates rather well the curve plotted for noninstitutionalized children under 10 years of age.

While the present study may appear to argue for the advantages of home-rearing and educationally-oriented placement supporting previous investigations comparing these two groups, caution must be exercised in drawing conclusions from these data. Birch and Belmont (1961) and Stott (1962) raised a number of questions regarding comparisons of home-reared children with other groups, and this study calls attention to the necessity of careful sampling in future research related to the mental development of persons with Down's Syndrome. As current legislative trends in the United States provide opportunities for educationally-oriented programs to children with Down's Syndrome, further research should contribute additional information regarding their mental development.

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