

AGEING AND COGNITIVE DECLINE IN PEOPLE WITH DOWN'S SYNDROME

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Introduction

Due to an increased life expectancy, adults with Down's syndrome are nowadays suffering from conditions that could not be observed before. Dementia is common in elderly persons with Down's syndrome with prevalences of about 5% with 41-45 year olds increasing to about 45% with 56-60 year olds (Visser, 1993). With nearly all persons with Down's syndrome dementia turns out to be Alzheimer's disease. It has been found that Alzheimer's dementia occurs 10-15 years earlier in subjects with Down's syndrome than in subjects without Down's syndrome (Lai and Williams, 1989; Evenhuis, 1990). Neuropathological investigations have shown that in nearly all subjects with Down's syndrome senile plaques and intracellular neurofibrillary tangles occur after 40 years of age, probably as a result of gene dosage (Rumble *et al.*, 1989).

It is not easy to diagnose dementia in people with Down's syndrome, because of the pre-existing mental handicap. Neuropsychological tests until now have insufficiently been evaluated for populations with IQ lower than 50. Therefore, internationally approved diagnostic criteria can not always be applied as such. Moreover, sensory impairments and hypothyroidism, which also are frequent in adults with Down's syndrome, may hamper the diagnosis. Nevertheless, timely diagnosis is necessary to inform relatives and caretakers, to exclude treatable conditions, and to reformulate the type of care and assistance that has to be provided. Therefore, an international consensus group has recently formulated a proposal for diagnostic criteria, based on ICD-10 (W.H.O., 1990), and diagnostic methods in this population (Aylward *et al.*, 1995).

As to now, no systematic research has been done with respect to possible

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decline of cognitive functions in persons with Down's syndrome of relatively younger age-groups. It was the aim of this cross-sectional study to get knowledge of:

1. The development of the cognitive functioning of persons with Down's syndrome between 10 and 50 years of age: decreasing cognitive abilities are expected to occur as a function of age.
2. Differences in the development of the cognitive functioning of intellectually disabled persons with and without Down's syndrome. Over a certain age, persons with Down's syndrome are expected to show a more rapid decline in cognitive functioning as compared to intellectually disabled persons without Down's syndrome.

Method

Subjects were randomly selected from the population of two Dutch homes for intellectually disabled persons. Within a two (Down's syndrome vs. non-Down's syndrome) x three (level of intellectual disability) x four (1-20, 20-30, 30-40 and 40-50 years of age) multifactor design, four subjects were attributed to each of the 24 cells. With respect to degree of intellectual disability the classification was used as in TABLE I.

Eventually data were collected from 94 subjects. Due to the composition of the population we were not able to obtain data from more than two subjects between 30 and 40 years of age with Down's syndrome and with a severe degree of intellectual disability.

In order to keep constant as many variables as possible, we matched each subject with Down's syndrome with a subject with intellectual disability by

other causes than Down's syndrome of the same age and level of intellectual disability living in the same unit.

The information with respect to the cognitive functioning of the subjects was obtained by means of the Dementia Questionnaire for Mentally Retarded Persons (DMR) (Evenhuis *et al.*, 1990). The DMR is a standardised hetero-anamnestic questionnaire that captures observational data on individual subjects in a structured manner. The questionnaire, based on DSM-IV criteria (A.P.A., 1994) and compatible with ICD-10 criteria (W.H.O., 1990), contains 52 three-point scale items, among them two repetitions. These items are attributed to eight subscales (3 cognitive and 5 social subscales (see TABLE II). The DMR was completed for all subjects by the first author during an interview of caregivers who knew the subjects at least 12 months. We used MANOVA to analyse the data.

Results

Sum of Cognitive Scores

Analysis of variance of the data given in TABLE III showed that there was a significant main effect with respect to the level of functioning ($F = 66.29, p = .000$), i.e. a relatively high level of functioning corresponds to a relatively low DMR cognitive sum-score, as has been reported before (Evenhuis, 1992). The main effects of 'Age' and 'Down's syndrome' turned out to be not significant.

The only interaction effect found to be significant was the interaction between 'age' and 'Down's syndrome' ($F = 3.45, p = .021$). With respect to the subjects with Down's syndrome, there is a decline

TABLE I
Levels of intellectual disability

Level of Intellectual Disability	IQ	Mental Age (yrs.)
High moderate	45-55	4,5 - 6
Low moderate	35-45	3 - 4,5
Severe	25-35	2 - 3

TABLE II
Subscales of the Dementia Questionnaire for Mentally Retarded Persons (DMR)

	Subscales	Scores (min.-max.)
Cognitive	1 Short-term memory (7 items)	0-14
	2 Long-term memory (8 items)	0-16
	3 Spatial and temporal orientation (7 items)	0-14
		0-44 sum of cognitive scores
Social	4 Speech (4 items)	0-8
	5 Practical Skills (8 items)	0-16
	6 Mood (6 items)	0-12
	7 Activity and interest (6 items)	0-12
	8 Behaviour disturbance (6 items)	0-12
		0-60 sum of social scores

TABLE III
The mean of the sum of the 3 cognitive scores as a function of age, level of intellectual disability and Down's syndrome, non Down's syndrome (n = 4 in each cell)

Age	Level of Intellectual Disability			Total
	High moderate	Low moderate	Severe	
Down's syndrome				
10-20	8.5	23.2	30	20.6
20-30	7.7	16.5	28.5	17.6
30-40	14.5	26.2	27.5	21.8
40-50	7.7	18.2	20.5	15.5
Total	9.6	21.0	26.6	18.9
Non Down's syndrome				
10-20	7.7	17.0	26.7	17.2
20-30	11.7	23.5	30.5	21.9
30-40	7.0	16.0	24.2	15.7
40-50	3.7	17.0	27.5	16.1
Total	7.5	18.4	27.2	17.7

in cognitive functioning in the 30-40 age group (= an increase in the sum of cognitive scores). With respect to the non Down's syndrome subjects on the other hand, a decline in cognitive functioning can be observed in the 20-30 age group. The differences between both groups of subjects is levelled out in the 40 to 50 year age range. We did not find the linear decline of cognitive functioning as a function of age which we expected in subjects with Down's syndrome.

Sum of Social Scores (5 subscales)

We also did an analysis of variance of the sum of social scores. We found a significant main effect with respect to the level of intellectual disability ($F = 132$, $p = .000$), i.e. a relatively high level of functioning corresponds to a relatively low DMR social score. This predictable result has been reported before

(Evenhuis, 1992). The univariate F-tests turned out to be significant ($p < .05$) with respect to the subscales 'speech', 'practical skills', 'activity and interest' (see TABLE VI). The level of functioning is of no significant influence however, regarding 'mood' and 'behaviour disturbance'.

We also found a significant main effect with respect to the factor (non) Down's syndrome ($F = 65$, $p = .05$). Univariate F-tests showed that this main effect is due to the scores on the subscales 'practical skills' and 'behaviour disturbance' (see TABLE V).

Hence, persons with Down's syndrome score lower (better) with respect to 'practical skills' and 'behaviour disturbance' than persons without Down's syndrome of the same age and the same intellectual level.

We did not find a significant effect for 'age' nor any significant interaction effect.

TABLE IV
The mean of 5 social scores as a function of the level of intellectual disability for both the Down's and non Down's syndrome group together

Level of Intellectual Disability	Speech	Practical Skills	Mood	Activity and interest	Behaviour Disturbance
High moderate	0.9	0.4	3.6	2.0	3.5
Low moderate	2.0	1.6	3.4	3.7	2.5
Severe	3.6	2.9	3.6	4.8	3.4

TABLE V
The mean of 5 social scores as a function of Down's syndrome, non Down's syndrome

	Speech	Practical Skills	Mood	Activity and interest	Behaviour Disturbance
Down	2.3	0.9	3.4	3.6	2.4
Non-Down	2.0	2.3	3.7	3.3	3.8

Discussion

It was hypothesised that as a function of age persons with Down's syndrome would score worse on the cognitive subscales of the DMR as opposed to a control group of persons with intellectual disability by other causes than Down's syndrome. Furthermore, over a certain age persons with Down's syndrome are expected to show a cognitive decline as opposed to the controls. Neither hypothesis were confirmed by the outcomes of the study.

Although differences in cognitive functioning between the groups with and without Down's syndrome were found, we did not find the expected decline. The age group of 30-40 year olds with Down's syndrome seems to constitute a risk group. This result is somewhat difficult to explain, because this tendency could not be observed for the 40-50 year old age group. Possibly, it may be due to the cross-sectional type of research design and the low number of subjects in each age group. A longitudinal research design is recommended for further research.

Results of this study indicate that the hypothesised onset of cognitive decline before the age of 50 years in person's with Down's syndrome is at least questionable.

Summary

In a cross-sectional study with 46 persons with Down's syndrome and 48 matched persons with intellectual disability due to other causes, aged between 10 and 50 years, data were gathered using the Dementia Questionnaire for

Mentally Retarded Persons measuring cognitive and social functions associated with dementia. A decline with age of the cognitive functioning of persons with Down's syndrome relative to the controls was expected, but clear evidence for this linearity has not been found. Our results suggest that the onset of cognitive decline in persons with Down's syndrome before the age of 50 is at least questionable.

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