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ORIGINAL RESEARCH

Teenage outcomes after speech and language impairment at preschool age

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Aim: Ten years ago, we published developmental data on a representative group of children (n = 25) with moderate or severe speech and language impairment, who were attending special preschools for children. The aim of this study was to perform a follow-up of these children as teenagers.

Methods: Parents of 23 teenagers participated in a clinical interview that requested information on the child's current academic achievement, type of school, previous clinical assessments, and developmental diagnoses. Fifteen children participated in a speech and language evaluation, and 13 participated in a psychological evaluation.

Results: Seven of the 23 teenagers had a mild intellectual disability, and another three had borderline intellectual functioning. Nine had symptoms of disorders on the autism spectrum; five of these had an autism spectrum disorder, and four had clear autistic traits. Six met criteria for attention-deficit hyperactivity disorder (ADHD)/subthreshold ADHD. Thirteen of 15 teenagers had a moderate or severe language impairment, and 13 of 15 had a moderate or severe reading impairment. Overlapping disorders were frequent. None of the individuals who underwent the clinical evaluation were free from developmental problems.

Conclusion: A large number of children with speech and language impairment at preschool age had persistent language problems and/or met the criteria for developmental diagnoses other than speech and language impairment at their follow-up as teenagers. Language impairment in young children is a marker for several developmental disorders, particularly intellectual disability and autism spectrum disorder.

Keywords: language impairment, dyslexia, developmental disorders, autism spectrum disorder, ADHD, follow-up

Introduction

Language impairments (LI) are common in young children and affect about 5% to 6% of preschoolers.[1] LI is frequently accompanied by other developmental problems, such as intellectual disability (ID), autism spectrum disorder (ASD), and attention-deficit hyperactivity disorder (ADHD).[1] Despite the presence of a more complex neurodevelopmental abnormality, LI is often the first deviation noted.

Miniscalco et al[1] found that 62% of the children who had had language delay at the time of speech and language screening at 2.5 years at the Child Health Care Center exhibited a major neuropsychiatric/developmental disorder at the follow-up conducted at 7 years.

Snowling et al[2] followed 71 children who had had early language problems up to the age of 15 years. The authors concluded that children whose language delay had

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been resolved by 5.5 years had particularly good outcomes but that the outcome was not as good for children whose language difficulties persisted through their school years. They emphasized that children with language difficulties at the age of their entry into school are a vulnerable group who require not only language-related intervention but also, in some cases, emotional and behavioral support. The follow-up revealed that the type of initial LI and the child's intelligence quotient (IQ) were related to different clinical subgroups in adolescence. Expressive LI was associated with attention problems, whereas receptive and expressive language difficulties were associated with social difficulties, and those who had a low IQ and both receptive and expressive LI exhibited both attention and social impairments in adolescence.

Proposals of unitary models to explain LI have not been successful, and there is mounting evidence that LI is a complex neurodevelopmental condition. In spite of the heterogeneous nature of the condition, it is clear that it is very often accompanied by limitations in underlying cognitive processes, such as working memory, executive functioning[3–5] and cognitive processing speed.[6,7] For example, verbal working memory has been found to correlate with several language processes in children and adults. It also plays an important role in language comprehension during the acquisition of language because it allows the learner to analyze and determine the structural properties of language.[8,9] Limitations in working memory, executive functioning, and processing speed are often seen in both ADHD and ASD,[10] conditions, which, as mentioned earlier, often overlap with LI.

We had previously studied a group of children aged from 5 to 7 years with moderate or severe speech and language disorder who were attending special preschools. At that time, 58 children born between 1993 and 1994 were attending these preschools. The children had been assessed by both a speech pathologist and a child psychologist before they were admitted to exclude those who had autism and those who had ID. The preschools accepted only children with moderate to severe LI. Our intention was to include all children, but limitations on the resources available for this project meant that two preschools had to be excluded, which corresponded to 18 children. Of the remaining 40 children, the parents of 15 children declined to participate. There was no indication from preschool teachers or speech pathologists that these children differed in their developmental profile from those who participated. Thus, this group was representative of children in special preschools for children with moderate or severe LI. We found that 90% of the children had additional developmental disorders or problems on the learning/intellectual spectrum, the autism spectrum, and the attention spectrum. We concluded that neurodevelopmental deviations were very common in children with LI and that the optimal route for the assessment and treatment of these children would be a multidisciplinary approach.[11]

The aim of the study presented here was to undertake a 10-year clinical follow-up of the children who participated in our previous preschool study and analyze their academic achievement, general cognitive abilities, associated developmental disorders or problems, and specific speech and language characteristics.

Methods

Participants

The participants consisted of the previously assessed preschool children with language impairment, who were a group of 25 children comprised of 18 boys and 7 girls between 5 and 7 years old at the time of the first study. When they were referred to the special preschool, they had all been considered to have no other developmental disorders besides LI.

In our previous study (Time 1), three children had an IQ indicating ID (IQ $\leq$71) and four had a borderline intellectual function (BIF) (IQ 72–85). Nine of the 25 children had symptoms corresponding to ADHD (inattentive, hyperactive-impulsive, or combined type). Eight children had symptoms in this area exceeding the 95th percentile of the reference group used. No child had a diagnosed ASD, but six children had definite autistic symptoms, and another five had fewer autistic symptoms that exceeded the 95th percentile of the comparison group. LI was classified as combined receptive-expressive language impairment in 21 children. One child was classified as exclusively receptive, and three children were classified as exclusively expressive.[11]

All parents of these 25 children were contacted in 2010, which was 10 years after the initial study. Two parents declined to take part in the follow-up study. Twenty-three parents were willing to participate and were interviewed. Fifteen adolescents, now aged 16 to 17 years, took part in the speech and language assessment, and of these, 13 also participated in the cognitive assessment.

Parental interview

The parents of 15 teenagers were interviewed in person regarding the clinical assessment. Eight teenagers declined to take part in the clinical assessment, so their parents were interviewed over the telephone. The interview followed a structured protocol, including the child's academic achievement, type of school attended, previous assessments and

diagnoses given at specialized neuropsychiatric or pediatric units after our initial assessment when the child was of preschool age (Time 1). The parents were also interviewed according to the ADHD symptom list.[12] All findings were compared with the corresponding data obtained from the relevant child's previous assessments.

Cognitive assessment

The cognitive assessment was carried out according to the Wechsler Intelligence Scale for Children – III.[13] All 13 subtests were used in the assessments. The verbal IQ, performance IQ, full scale IQ, and the four Kaufmann indices were calculated. These are the indices for verbal understanding, perceptual organization, freedom from distractibility (FDI), and processing speed (PSI).[13] The FDI is composed of the Digit span and Arithmetic subtests, both of which express working memory. The PSI reflects capacity of simultaneous processing and focus shift. Data were compared with the results from each individual's previous assessment during preschool. At that time, the Leiter Nonverbal Scale was used.[14]

In addition, an evaluation of academic performance (final grade after the 9th school year) was performed for each child.

Language, speech and reading assessments

A two-step compilation of language and reading data was performed in order to determine and classify the levels of language and reading achievement of each participant. The following subtests were used (reading related assessments are marked with^{R} and language related assessment are marked with^{L}). LOGOS,[15] a standardized computer-assisted test battery, was used to assess the following skills: reading fluency^{R}, reading^{R} and listening comprehension^{L}, orthographic reading^{R} (word sight reading), phonological decoding^{R}, phonological awareness^{R}, and rapid automatic naming^{L}. Spelling^{R} and conceptual word comprehension^{L} were assessed by a subtest in a Swedish reading test, DLS (Diagnostiskt test för Läsning och Skrivning [Diagnostic Reading and Writing test]).[16,17] Vocabulary^{L} was assessed by the Boston Naming Test.[18,19] Sentence comprehension^{L} was assessed by the Test for Reception of Grammar (TROG 2).[20]

In the first step, the results from each subtest were classified as follows: normal if ≥ the 30th percentile or stanine 3: moderate problems if < the 30th percentile or stanine 3; and severe problems if ≤ the 15th percentile or stanine 2. In the second step, a compiled classification of overall receptive language level and overall reading level was defined as follows: normal if the results in all assessments regarding reading or language ≥ the 30th percentile or stanine 3; moderate problems if < 30th percentile or stanine 3 in one or more of the assessments; and severe problems if ≤ the 15th percentile or stanine 2 on one or more of the assessments.

An assessment of phonological and dyspraxic speech symptoms was performed by two independent language pathologists who analyzed speech recordings of each participant as they told a short story. Speech was rated as normal, deviant but not difficult to understand, markedly deviant, or difficult to understand. There was complete interrater agreement.

The Regional Ethical Review Board in Stockholm approved the study, which was performed under the tenets of the Declaration of Helsinki.

Results

General cognitive data

Thirteen individuals were assessed by the psychologist at the time of the follow-up. Six had an average intellectual function, four had ID, and three girls had BIF. For ten children, information was given at the parental interview. Seven of these had average intellectual function, and three had a diagnosis of ID, which had been made after an assessment by a specialized team.

Mean verbal and performance IQs, as well as verbal understanding and perceptual organization indices, did not differ from age norms. There was no significant difference between the mean verbal and performance IQs. However, the freedom from distractibility and the processing speed indices were significantly lower compared to the age-equivalent norms ($t_{12} = -4.28$; $P = 0.001$ for freedom from distractibility and $t_{11} = -4.06$, $P = 0.002$ for processing speed) (see Table 1). On an individual basis, none showed a significant difference between verbal and performance IQs.

Table 1 Cognitive data in 13 teenagers at follow-up: IQs and Kaufmann indices

WISC-III	N	Mean	SD	95% CI for mean indices
FSIQ	13	85.08	29.54	67.22–102.93
VIQ	13	82.46	27.84	69.03–102.47
PIQ	13	91.85	25.39	80.31–110.03
VUI	13	85.38	25.63	71.87–103.80
POI	13	96.31	23.98	84.11–113.56
FDI	13	76.85	19.49	66.33–90.83
PSI	13	79.31	16.84	69.13–89.49

Abbreviations: CI, confidence interval; FSIQ, full scale intelligence quotient; IQ, intelligence quotient; VIQ, verbal intelligence quotient; PIQ, perceptual intelligence quotient; VUI, verbal understanding index; POI, perceptual organization index; FDI, freedom from distractibility index; PSI, processing speed index; WISC-III, Weschler Intelligence Scale for Children – III.

ADHD

Two individuals met the full criteria for ADHD symptoms (ie, they met at least six of the nine attention-related criteria) at the follow-up, and four met four of the nine criteria, ie, subthreshold criteria.[21] One girl had severe clinical executive function problems, but according to the parental interview, she did not meet the attention symptom criteria. Thus, six of the 23 individuals had definitive ADHD/subthreshold ADHD, and of these six individuals, five also had a diagnosis of ASD or clear autistic traits.

Autism spectrum disorders

Five of the 23 participants had been assessed at specialized units and been given a diagnosis of ASD; autism (n = 1), atypical autism (n = 2), and Asperger's syndrome (n = 2). Four were found to have clear autistic traits according to data that were communicated by their parents, which was also observed at the cognitive assessment. One of these four had recently been admitted for a diagnostic work-up owing to suspected ASD.

Language and reading data

Thirteen of the 15 individuals (87%) who were assessed during the follow-up had LI; seven were classified as having moderate LI, and six as having severe LI. Thirteen of the 15 (87%) had reading deficits; seven of these were moderate and six were severe. The existence of language and reading-related problems were overlapping except in two cases. Of the six children with severe LI combined with a severe reading disorder, four had ID and two had BIF (see Table 2).

Table 2 Cognitive, ASD, ADHD, and language and reading results at a preschool age and at the follow-ups (time 1 and time 2)

Id	Sex	Cogn (T1)	Cogn (T2)	ASD (T1)	ASD (T2)	ADHD (T1)	ADHD (T2)	LI type (T1)	LI degree (T2)	Readd disab. level (T2)
1	m							rec. + expr.		
2	m							expr.		
3	m		*		*		*	rec. + expr.	*	*
4	m							expr.	No data	No data
5	m							rec. + expr.	No data	No data
6	m							rec. + expr.	No data	No data
7	f							rec. + expr.		
8	m							rec. + expr.		
9	m							rec. + expr.	No data	No data
10	f							rec. + expr.		
11	f							rec. + expr.		
12	m							expr.		
13	m							rec. + expr.	No data	No data
14	m							rec.		
15	f							rec. + expr.	No data	No data
16	m							rec. + expr.	No data	No data
17	m							rec. + expr.		
18	f							rec. + expr.		
19	f							rec. + expr.		
20	f							rec. + expr.		
21	m		*		*		*	rec. + expr.	*	*
22	m							rec. + expr.		
23	m							rec. + expr.		
24	m							rec. + expr.		
25	m							rec. + expr.	No data	No data

Notes: *Subject declined the offer to participate in the study at T2. **Cognitive level:** Green = normal (IQ > 85), orange = BIF (T1; IQ 72–85, T2; IQ 71–85), red = ID (T1; IQ ≤ 71, T2; IQ ≤ 70). **ASD:** Green = ASD symptoms did/do not apply (T1, T2), orange = a few autistic symptoms, but exceeding the 95th percentile for the comparison group (T1); clear autistic symptoms, but not full ASD (T2); red = definite autistic symptoms (T1); ASD diagnosis given (T2). **ADHD:** Green = ADHD symptoms did/do not apply (T1, T2), orange = ADHD symptoms exceeding the 95th percentile of the comparison group (T1); subthreshold ADHD (4/9 criteria according to DSM-IV) (T2), red = ADHD definitely applied according to DSM-IV criteria (T1, T2). **LI type (at T1):** Orange = expressive language impairment, red = receptive and expressive language impairment, blue = receptive language disorder. **LI degree (at T2):** Green = normal (all language assessment results > the 30th percentile or stanine 3), orange = moderate problems (one or more of the language test results < 30th percentile or stanine 3), red = severe problems (one or more of the language test results ≤ the 15th percentile or stanine 2). **Reading disability level (at T2):** Green = normal (all reading assessment results > the 30th percentile or stanine 3), orange = moderate problems (one or more of the reading test results ≤ 30th percentile or stanine 3), red = severe problems (one or more of the reading test results ≤ the 15th percentile or stanine 2).

Abbreviations: ADHD, attention-deficit hyperactivity disorder; ASD, autistic spectrum disorder; T1, results from earlier study; T2, results from the study presented here.

Moreover, it was noteworthy that in the language assessments, 12 out of 15 performed at or below the 15th percentile on the assessment of conceptual word comprehension; four of these 12 individuals had ID and three had BIF. The results for reading fluency and spelling were below the 15th percentile in 12 and 11 of the 15 cases, respectively. In spite of the low reading fluency, 10 of the 15 participants had superior reading comprehension compared to listening comprehension, and of these 10 individuals, 5 had ADHD or subthreshold ADHD.

In six of the 15 individuals, elements of phonological deficits or dyspraxia were evident in their speech. Two of the six individuals had marked articulation deficits and three of these six teenagers also had ID.

The developmental outcome for each individual is presented in Table 2. When the cognitive results at the follow-up were compared with the data from the preschool assessment (using the Leiter test), it was found that the three children with ID at the first assessment still fulfilled the criteria for this disability. Another four of the participants were determined to have ID at the follow-up; two of these four had been considered to have BIF and two had a normal intellectual function when they had been assessed in the preschool study. Two children who were considered to have an average intellectual function in the first assessment were found to have BIF by the follow-up. At the time of the preschool study (conducted at 5 to 7 years), three had ID and four had BIF.[11] Thus, the intellectual function of a total of six children was found to have deteriorated, whereas 17 remained in the same intellectual category.

None of the nine individuals who were found to have symptoms that corresponded to ADHD during the first assessment in preschool met the ADHD criteria at the time of the follow-up; however, five of them were found to have ASD or clear autistic symptoms at the follow-up. At the follow-up, six of the eight individuals with attention and/or hyperactivity-impulsivity symptoms exceeding the 95th percentile of the comparison group as preschoolers no longer had such ADHD symptoms; however, one had ADHD and one had subthreshold ADHD. The changes in the ADHD symptoms are illustrated in Table 2.

In the preschool study, eleven children had autistic traits that were mild or definite according to preschool reports. At the follow-up, five children had a diagnosis within the autism spectrum and four had traits. Three of the six children who had had definite autistic symptoms at preschool age had a definite autism spectrum disorder at the follow-up. The changes in the autism symptoms are illustrated in Table 2.

At the time of the follow up, four individuals were enrolled in the program of general academic studies in upper secondary school (id numbers 11, 12, 14, and 15; Table 2). The others either were in a program for vocational training in the upper secondary school for the mentally retarded or had not yet finished the 9-year program of compulsory school education.

At the time of their referral to the speech and language preschool, no child had received any additional diagnosis although that all of them had been assessed by a psychologist and a speech and language pathologist. Their only diagnosis was LI. However, in connection with our preschool study, we identified accompanying developmental problems in about 90% of the children. At the follow-up conducted when they were teenagers, only one individual was free from language and reading problems. This boy had had an exclusively expressive LI at preschool age, but according to the assessment conducted at that time, he had had ADHD and mild autistic symptoms. At the follow-up ADHD was not confirmed.

Discussion

This follow-up study describes the outcomes for 23 out of 25 adolescents who 10 years earlier had had moderate or severe LI. At that time, 90% were found to display associated developmental problems. The group included in this study is small, but at the time of the initial assessment, the group was representative of all preschool children attending special preschools for language impaired children in the county, and they had been assessed with a multidisciplinary approach.

The main result of this 10-year-follow-up study, also performed with a view to assessing different kinds of developmental problems, was that all adolescents exhibited developmental problems of various types and combinations. For the majority, language impairment was not the main problem. Instead, their developmental profiles were dominated by a variety of cognitive dysfunctions that in many cases overlapped. These were general cognitive impairments, ASD, and deficits within the attention spectrum. Of the 15 individuals who took part in the language and reading assessments, only four (id numbers 1, 2, 8, and 11; Table 2) had language and reading problems as their main developmental disorders, and no other developmental disorder was identified at the follow-up. Of these four individuals, one had had exclusively expressive LI at preschool age.

At the time of the follow-up, one third of the children had ID or BIF. At the first cognitive assessment conducted during preschool, three were found to have an IQ at or below 71,

whereas at the time of the follow-up, seven had definite ID. The cognitive test used at the first assessment was a non-verbal test (Leiter), which may have contributed to the low detection rate of children with ID at that time. Moreover, developmental problems that are apparent at an early age are not always easy to disentangle and assign to a definite diagnostic category. This difficulty highlights the importance of always planning a follow-up for children exhibiting any type of developmental disorder. LI is a marker for several developmental disorders, particularly ID and ASD.

The cognitive assessments revealed that the freedom from distractibility and the processing speed indices were significantly lower than the age norms, which supported a close connection between LI and working memory deficits. We found no significant difference between the verbal and performance IQs, neither on a group level nor on an individual level. Our results accord with findings by Tomblin and Zhang,[22] who demonstrated that language impaired children, whether with a performance IQ below or above 85, had the same patterns of language deficits and that there was very little evidence to suggest the inclusion of a performance IQ criterion in the clinical diagnosis of developmental language impairment.

Nine of the 23 individuals had ASD or clear autistic traits, which in many cases were combined with ID and/or concomitant attention deficits. Definite attention problems or ADHD were evident in approximately one-fourth of the group, when subthreshold ADHD was taken into account.[21] The difficulties in differentiating between ADHD, ASD, ID, BIF, and LI in young children were clearly demonstrated by the shifts in diagnostic categories between the two assessments.

Hence, the clinical picture obtained for this group of children at preschool age and from a follow-up conducted in their mid-teens was in strong accordance with the concept of the Early Symptomatic Syndromes Eliciting Early Neurodevelopmental Clinical Examination (ESSENCE).[23] This concept highlights the evidence that young children with developmental problems should always be assessed with a broad view to identify disorders in different developmental domains. The concept also highlights the importance of always planning for a follow-up of children with developmental deviations in order to identify changes that may occur in a child's developmental profile.

One limitation of the study presented here is that it could only encompass the 23 children who were eligible for a follow-up in their teens.[11] Another limitation is that only 15 and 13 of the 23 adolescents participated in the direct speech and language and reading assessment and the cognitive assessment, respectively. However, this was partly compensated for by the information obtained from other assessments and the information that the parents provided.

The study presented here has confirmed earlier findings that language impairment is usually part of a larger developmental disability. Furthermore, speech and language development is a useful indicator of a child's overall development and cognitive ability and is related to school success.[24] Children with language impairment should be provided with a range of clinical and educational services adapted to their special needs in order to optimize their development.[25]

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Disclosure

The authors report no conflicts of interest in this work.

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