

Multisystem Developmental Disorder in Children from 2 to 6 Years Old: A Three Years Follow-Up Study

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Received 21 March 2014; revised 19 April 2014; accepted 8 May 2014

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Abstract

This research studied children who had been diagnosed with Multisystem Developmental Disorder (MSDD) (NC, 2002) under the Diagnostic Classifications of Mental Health and Developmental Disorders of Infancy and Early Childhood (DC: 0 - 3). They all showed, to a varying degree, difficulties in relating to others, play, affective interaction and severe delay in developing communication skills. Some studies have observed continuity in the diagnosis of autism during the first years of life. The objective of this study is to analyse the development of infants with MSDD whose diagnosis of autism was not confirmed. We also attempted to verify any possible psychomotor developmental differences based on, or related to, the severity and typology (B and C) of the MSDD. To enable us to do this we carried out a 3-year follow-up during which we assessed the infants (n = 15) and their parents. They are 2 - 4 years old. Results showed that type B children did present a greater impairment of psychomotor development in assessment tests. However, we did not observe any correlation between the degree of severity of the initial symptoms and later diagnoses. Conclusion: although our sample is small, we can conclude that there isn't a clear evolution in the diagnosis, but we have found significant differences in the symptomatology between the type B and C.

Keywords

Multisystem Developmental Disorder (MSDD), Development, Diagnosis, Early Childhood, Autism Spectrum Disorder (ASD)

1. Introduction

Research on Autism Spectrum Disorder (ASD) has always generated a great deal of interest. Recent studies have given rise to valuable information both on diagnosing the disorder and its treatment. Estimations of the prevalence of ASD are constantly being revised. Recent suggestions indicate that is 1% (APA, 2013) with a sex proportion 4:1 boys than girls.

While autism is a disorder which is usually first diagnosed in early childhood, we still do not know much about the factors that do, or do not, cause favourable responses, what kind of treatment is most effective and what are the factors that can contribute to an increase in its occurrence.

Public health care in Catalonia includes Early Intervention Centres (Centre de Desenvolupament Infantil i Atenció Precoç [CDIAP]). These are organisations which provide services to infants with developmental delays and disabilities from birth to 6 years of age and their families. Some of these families have 2-year-old toddlers who may display patterns which we can relate to Multisystem Developmental Disorder (MSDD) (DC, 0 - 3 National Center for Clinical Infant Program, 2002). These include: poor eye contact, little interest in interaction with others and toys, stereotyped behaviour, language delay and behavioural disorders. These difficulties may vary both in form and severity, and we differentiate between MSDD types A, B or C according to severity, with A being the most affected and C the least affected.

The defining characteristics of Multisystem Disorder Development (MSDD) are:

- 1) Significant impairment, but not complete lack of ability to engage in a social and emotional connection with the primary caregiver.
- 2) Significant deterioration of the formation, maintenance and/or development of communication. Gestural communication includes verbal, as well as verbal and nonverbal symbolic communication.
- 3) Significant auditory processing dysfunction.
- 4) Significant dysfunction processing other sensations, including excessive or insufficient reactivity and motor planning.

We can differentiate the degree of involvement in MSDD Pattern A, B or C, from most to least affected.

1.1. Pattern A

Children living without relating most of the time, with severe motor planning difficulties. They show little affection and sometimes manifest improper or poorly modulated behaviour. In these children there is a high degree of rhythmic behaviours, autostimulation and more organised conduct with objects instead.

Many have poor muscle tone and tend to be hyperreactive to feelings, thus requiring input to become increasingly intense in order to achieve a response. They have selective patterns of hyperreactivity to sensations, such as contact or certain types of noise.

1.2. Pattern B

Children who are intermittently connected and are able to perform simple intentional gestures for part of the time. In this group, affection seems accessible, but it is ephemeral, with small islands of superficial satisfaction or pleasure, but they are without interpersonal warmth and systematic. They tend to enjoy an activity with repetitive or persistent objects, but they are very rigid and react intensely to any changes in their environment. Children with these characteristics have mixed patterns of sensory reactivity and muscle tone. They are much more organised than children with pattern A, with regard to how they look or prevent sensations. They often control the amount of sensory input and emotions they can absorb, expressing their intentions in deliberate avoidance patterns or negativism.

1.3. Pattern C

These children tend to avoid an ongoing relationship, but can have moments of affection and warm relationship. They know simple social gestures and form complexes occasionally. Don't like to change and are perseverative. Another feature is hyperresponsiveness to sensations.

Clinical experience has shown us that some of the children diagnosed with MSDD eventually develop autism or other autism spectrum disorders. However, there is a percentage of these children who develop other kinds of pathologies or developmental disorders (Chawarska, Klin, & Volkmar, 2007; Landa & Garret-Mayer, 2006).

These infants initially shared similar symptoms which eventually developed in different directions. What variables could be contributing factors in this convergent process?

As early development specialists, we also encounter other issues, for example, the lack of an internationally recognised diagnostic classification for pre-schoolers. Currently, we can account for a very specific and accurate diagnostic classification for infants aged 0 to 3, as well as classifications for both adults and school-age children. However, this does not include pre-schoolers over 4 years of age for whom finding an accurate diagnosis can be very difficult.

While there are a large number of studies on ASD there are very few which are specific to 2- to 5-year-olds with MSDD. Carrying out an evaluation in such young infants is difficult and is made even more so due to the expressive, interaction and communication difficulties which characterise infants with MSDD. In addition, we know little about the different factors affecting the development of autism growth along; (Charman, Taylor, Drew, Cockerill, Brown, & Baird, 2005; Ventola, Kleinnam, Pandey, 2007; Turner, Stone, Pozdol, & Coonrod, 2006; Sullivan, Finelli, Marvin, et al., 2007; Lord, 1995). Furthermore, there are fewer studies which have used specifically the 0 to 3 Diagnostic Classification.

The purpose of this article is to demonstrate the longitudinal research we carried out to follow up the development of the diagnoses of those children initially diagnosed with

MSDD during their three year attendance at our CDIAPs. Our aim was to understand the different directions in which these diagnoses can evolve, and whether there is any possible way of anticipating these different paths according to the severity of the first diagnosis (specifically for MSDD types B and C).

The hypothesis are:

1) Children diagnosed with multisystem developmental disorder develop differently according to whether they have a severity of type B or C. Initially, our expectation was that, by the time they are discharged from the Centre, infants with type B will have been diagnosed with autism spectrum disorder. While we would expect those children diagnosed with MSDD type C to be diagnosed within a wider spread of diagnoses such as language delay or disruptive behaviour disorder.

a) There will be personal and family characteristics that we can explain the differences between the two groups.

b) The test scores will be different between the two groups.

2) Infants with MSDD type C who are undergoing some kind of intervention will develop more favourably with regards to their communication, relationship, motor, language and cognition skills.

2. Method

2.1. Participants

Four CDIAPs (Garrotxa, Baix Empordà, Alt Empordà and Gironès) from four different areas of Girona (Spain) have participated in this study. Participants in the study were toddlers who had been clinically diagnosed with MSDD under the 0 to 3 diagnostic classification (NC, 2002) at the CDIAPs during the period from January to December 2007. Participation was voluntary and had a 100% participation rate. The children's ages ranged from 2 to 4 years old.

Out of the 687 total entries in the CDIAPs during the study recruitment period (January to December 2007), 15 were diagnosed with MSDD, of which 10 were type B and 5 were type C. Ages ranged between 24 and 47 months; 20% of the sample were 31 months old while 50% were 30 months old or less. The gender split was 67% boys and 33% girls (Table 1).

2.2. Instruments

The following tests and surveys were used:

Parental questionnaire: Anamnesis and clinical history detailing data on the development of the infant, from conception to the moment of the interview.

Screening Test—Battelle Developmental Inventory Screening Test. (BDIST, Newborg, 1984): The Spanish version from the Catalan Foundation for Down's Syndrome was used (1989). Statistically, the results predict the full Battelle Developmental Inventory test (BDI) within a correlation equal to or higher than .96. The reliability and validity of the screening test are high, with correlations between BDI and the screening test of above .90.

Table 1. Breakdown of data by age and sex.

Variable	
Sample	N = 15
Sex	67% boys 33% girls
Diagnoses	Type B = 10 infants Type C: 5 infants
Age	24 - 47 months

BDI is a standardised, individually administered assessment battery of key developmental skills in children from birth to 8 years of age.

It also includes a screening test which allows for a quick assessment of the child's level of development in each domain at the moment of evaluation. The developmental domains assessed are:

Personal/Social: assessing the skills and characteristics that enable a child to create significant social relationships.

Adaptive: assessing the capacity of the child to use information from the other domains.

Language: assessing expressive and receptive communication skills.

Motor: assessing gross and fine motor skills.

Cognitive: assessing abilities and skills of a conceptual nature.

The internal consistency of all the domains is very high, with correlations higher than .90.

Escala de Evaluación del Autismo (ATA, Autism Evaluation Scale, Jané, Capdevila, & Domenech, 1994). Designed as an early diagnostic instrument for autism. This is a standardised test that evaluates the child's behavioural pattern according to a number of diagnostic criteria. It has a reliability of .81, 100% sensitivity and a specificity of 50%, following DSM-IV criteria. Its global efficiency index is 90.69%.

ATA is an observation-based test that allows for a longitudinal follow-up of the development of the symptoms of autism. The higher the score within the scale, the higher the severity of the symptoms.

Autism Diagnostic Interview-Revised (ADI-R, Rutter, Le Couteur, & Lord, 2006): This is an interview-based questionnaire designed to provide a comprehensive evaluation of autism and autism spectrum disorders. ADI-R focuses on the specific behaviours of this disorder. It is appropriate for adults and children with mental ages from 2 years and above. Its test-retest reliability is .93 and .97. The correlation coefficient within examiners is 0.72.

The interview focuses mainly on three domains: language and communication, reciprocal social interactions, and restrictive, repetitive and stereotyped behaviours and interests.

Early Childhood Inventory (ECI, Sprafkin & Gadow, 1996, Spanish version). This is a screening tool for symptoms of cognitive, behavioural and emotional psychiatric disorders of pre-school children. There is a direct correspondence with DSM-IV diagnostic criteria, which gives it a high content validity. Its sensitivity and specificity are very high, with an internal consistency that oscillates between .62 and .94. The measurement can be categorical or dimensional. The symptoms have been given a binomial value where 0 = never/sometimes and 1 = often/very often in a categorical assessment.

It includes a scale for parents and another for teachers. For this research we have used the parental scale. ECI allow us to gather information on disruptive disorders such as: ADHD, tics, obsessions, emotional disorders, behavioural disorders, post-traumatic stress, autism and Asperger syndrome.

Data collective grid: Designed by our research team. This is a user-friendly grid that allows us to keep all the scores in all the tests and questionnaires used throughout the 3 year investigation. The data collected in the grid comes from the previously mentioned assessment instruments: ATA, ECI, ADI-R and BDI.

3. Procedure

All the professionals involved in the investigation are qualified psychologists with a minimum of 10 years clinical working experience. All the professionals underwent a one-year training period with the objective of ensuring uniform criteria for evaluation and diagnostic procedures.

We agreed to target as our sample all those infants attending the 4 CDIAPs who had been diagnosed with MSDD during the period from January to December 2007.

All participant families were given a presentation and consent letter; 100% of the parents of the eligible infants gave their consent. Subsequently, we administered the BDI screening test and the ATA scale to the children and the ECI, the ADI-R interview and the parental questionnaire to the corresponding parents. However, the ADI-R interview was not administered to parents where the children had a mental age of lower than 2 years. All participant children were given therapy at the CDIAPs, 80% of them for one hour a week and 20% for two hours a week, according to the severity of the symptoms and their personal situation. In the four centers it's follow the same line of intervention, based on cognitive behavioral therapy and stimulation. Throughout the subsequent three years, we administered annual tests and questionnaires to the infants and families in order to statistically analyse by means of the SPSS statistics programme 15.0, the changes that might have occurred. Data was analysed with the non-parametric tests of Friedman and χ^2 de Pearson. The statistical significance was $p < .05$).

4. Data Analysis

4.1. Children with MSDD Type B Will Evolve towards ASD, Whereas Children with MSDD Type C Will Produce a Variety of Diagnoses throughout the Three-Year Period of the Study

On comparing infants diagnosed with MSDD types B and C:

4.1.1. In Relation to Personal Data

There are no significant differences according to gender. However, we did observe a common trend: 66.7% of our sample was diagnosed with MSDD type B and, of those, 60% were male and 40% were female. This tendency increased for type C, where 80% were male while only 20% were female.

There are no differences within the two groups according to the country of origin.

Similarly, we did not find differences within the two groups in relation to pre- and post-natal data, such as birth weight, height, type of pregnancy, abnormal amniocentesis test or metabolic cribbage, and stressful situations during pregnancy. Nor could we find a correlation between the type of disorder and having or not having a relevant family history.

4.1.2. When Analysing the Administered Tests

ATA: We found significant differences between the sample's mean scores throughout the three years (**Graph 1**) (Friedman: 11.164, $p = .004$). There is a decrease of the scores and, therefore, of the severity of the symptoms shown by this test.

We can observe type C ($M = 18.80$, $sd = 3.42$) scores lower than type B ($M = 28.36$, $sd = 5.65$) in the first administration of the test. Therefore, type C shows less initial severity.

However, there is no relationship between the values of the initial administration and the diagnostic development throughout the three years $\chi^2 (1, N_{15}) = .55$. NS).

4.1.3. In Relation to Diagnostic Variability

At the end of the three year period, we can observe that 13% of the infants have been diagnosed with an autistic disorder, 67% with Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS) and 20% with other diagnoses (mental retardation, ADHD, disruptive behaviour and language delay) in accordance with DSM-IV APA criteria. With respect to initial diagnoses, we found significant correlations between two of our assessment instruments: ATA and ADI-R scales A and C (**Table 2**).

Table 2. ADI-R scales punctuation.

Variable	Value	Sig
ADI-R A	.615	.04
ADI-R B	.093	.86
ADI-R C	.735	.03
ADI-R D	.000	1

4.2. Those Children Diagnosed with MSDD Type C Developed More Favourably in Cognition, Language, Communication-Relationship and Motor Skills

Generally, we found worse scores in the developmental test as the years went on, leading to a standard deviation of two negative in the final evaluation. We carried out an analysis of the different domains of development throughout the three-year period and classified them into four different categories: 1) improvement, 2) no changes, 3) minor deterioration, and 4) major deterioration. These have been defined as 1) an increase in the score (improvement), 2) no change in the score (no change), 3) a score that has fallen by up to 20 points (minor deterioration) and 4) a score that has fallen by more than 20 points (major deterioration). See **Graph 2**.

Adaptive domain: 71.42% of the cases show deterioration (78% from type B) and 21% show improvement (65% from type B). While type B children show a certain dichotomy, we found more variability throughout the three years amongst type C children, with some children showing no changes, some children improving and others deteriorating (22.22% of the cases had a good evolution while 77.77% worsened). These differences, however, are not statistically significant, $X^2(1, N_{14}) = .33$. NS).

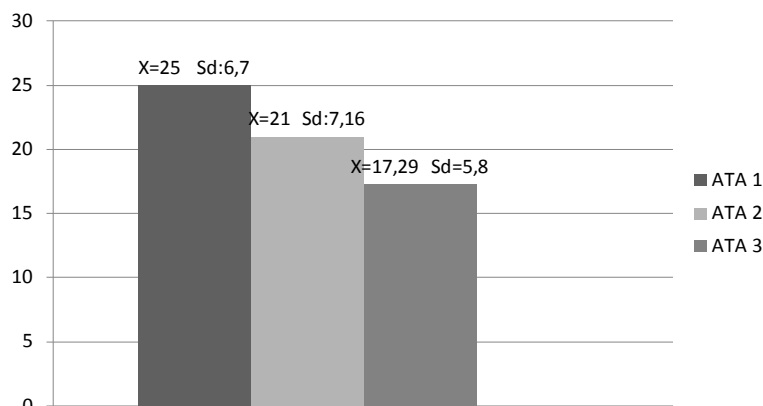
Social domain: we did not observe statistically significant differences between the first and the third year $X^2(1, N_{14}) = .302$. NS). However, within type B we noted deterioration in a larger percentage of children (65%). In no cases did we find improvement within the three year period.

Motor domain: the 80% of children who improved within this area all belonged to type C. Only the children within type B deteriorated.

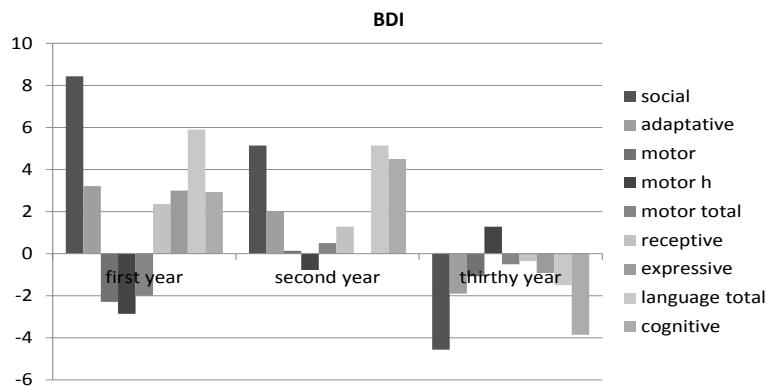
Regarding manipulation, 100% of the type C children had a positive outcome. $X^2(1, N = 15) = .52$. NS).

Receptive language domain: within this domain, while type C children showed a variety of outcomes, there was no improvement for any child within type B. $X^2(1, N_{15}) = .115$, NS).

Sig. <.05



Graph 1. Puntuación ATA in 3 years.



Graph 2. Psychomotor evolution in BDI scales.

Expressive language domain: type B showed an improvement in 11% of the cases, while type C showed an improvement in 20% of the cases. In this area both types B and C showed 78% of cases experiencing minor deterioration. $X^2(1, N_{15}) = .69$. NS).

Cognitive domain: type B was the only group where data was collected relating to cognitive development and showed an overall deterioration. $X^2(1, N_{15}) = .37$. NS).

5. Discussions

Both at a clinical and practical level, we have always believed that the more severe the initial symptoms, the worse the prognosis would be. We have, however, been able to observe that this is not always true, and that while some children will show a less severe diagnosis of autism spectrum disorder, others will go on to develop full severe autism disorder independently of the severity of their initial evaluation. Even though infants with MSDD type B, score higher values in autism symptoms (ATA) and worse scores in the developmental scale (BDIST), this does not affect the diagnosis at the third year.

Despite gathering pre-, peri- and post-natal data, we were unable to determine any specific variables which would explain the diversity of the diagnosis at a statistically significant level.

With regard to evaluation, we can observe that both ADI-R and ATA allow us to evaluate and differentiate the severity of the disorder. This also corroborated the clinical criteria of the psychologists. Attention deficit symptoms, lack of interest in learning and stereotyped movements were the most persistent items throughout the three years.

In both groups, ASD remains as the main diagnosis. However, we determined that overtime, some of the children developed other kinds of disorders which were them themselves subject to further research in other autism disorders (Mendoza & Muñoz, 2005; Ventola et al., 2007; Osterling et al., 2002; Charman et al., 2005). Furthermore, our results do appear to indicate that infants with MSDD type C tend to show better results in language and personal and social skills than infants with type B. We have also been able to observe how infants with MSDD type C tend to show less deterioration over the years while, infants with type B vary greatly in their overall development. Unfortunately, we cannot statistically prove these theories. Even though it is not corroborated by statistical analysis, on the whole, we observed that infants with type C tend to score higher values than infants with type B in domains such as sociability, adaptive, language and cognition skills.

Those infants from type C show better aptitudes for relating to others, and also, they show better access to expressive language, they may even be able to use some words in a simple manner. We need to take into account the small size of our sample, which has probably limited our results and statistical analysis. However, the fact that this study has been carried out solely on such young children gives it real value. The reason our sample only included children who had only just been admitted to the centres and with no previous clinical treatment is that we wanted to have control over both the process of diagnosis and the subsequent development of the child.

This research has provided important insights; however, it is important to continue studying the early stages of development and to carry on working on the issues explored in this article.

It would be very interesting to do a follow-up of our sample in subsequent years and to assess how their diagnoses evolve. We should also do a similar study with a larger sample.

Finally, we would like to stress the importance of early childhood intervention, both for the development of the child and the parents' understanding of this disability (Dawson, 2008; Mahoney & Perales, 2005; McConachie & Diggle, 2007).

6. Conclusion

Pre-, peri- and post-natal data taken from the parental questionnaire do not show statistically significant differences between types B and C. Regarding the diagnostic evolution, we find variability in both groups B and C: 20% show other diagnoses, such as mental retardation, language disorder, ADHD, etc. We have to take into account that our clinical sample is small and it would be very interesting to reproduce the study with a larger sample.

We have found significant differences between types B and C in: ATA, BDIST personal-social, language and adaptive skills tests. Type B scores are higher than type C. Type B scores are highly under deviation: two negative in BDIST, but not so in type C. After analysing the items from the assessment instruments used, we can conclude that overall, type B children tend to be more solitary and show repetitive behaviours. There are no

other relevant differences.

Concerning the two types, we can see that type C scores over type B in the BDI scale both in sociability and language. Those infants from type C show better aptitudes for relating to others, and also, they show better access to expressive language, they may even be able to use some words in a simple manner. After analysing the results from ATA and ADI-R (A and C), we can corroborate the importance of interaction, communicative intention disability and limited interests behaviour, as main factors for detection, even more relevant than expressive verbal language itself in these early stages of life.

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Appendix (Catalan Version) **Qüestionari Dirigit Als Pares**

1. Data de naixement:

2. Edat inici al Servei:

3. Dades Perinatal

3.1. Fill Fruit:

1. Embaràs Natural
2. Mètode reproducció assistida
3. Adopció

3.2. Va ser un embaràs:

1. Desitjat
2. Inexperta
3. Rebutjat

3.3. Aminiocentesi:

1. Normal
2. Alterada
3. No es va fer

3.4. Escreening metabòlic alterat?

Si No

3.5. Va a viure una situació d'estrès durant l'embaràs?

Si No

3.6. Part a les setmanes de gestació: ____

3.7. Tipus de part:

1. Eutòcic
2. Distòcic

3.8. Pes al néixer: _____

3.9. Talla al néixer: _____

3.10. Perímetre cranial: _____

3.11. Apgar:

3.12. spectes rellevants del Postpart

4. Antecedents Familiars

4.1. La mare va patir depressió post-part?

1. Si 2. No

4.2. Hi ha antecedents familiars de depressió?

1. Si 2. No

4.3. Antecedents familiars d'ansietat?

1. Si 2. No

4.4. Antecedents familiars d'altres alteracions psiquiàtriques?

1. Si 2. No

4.5. Quines? _____

5. Situació Familiar

5.1. Situació de la parella:

1. Junts
2. Separats
3. Separats amb nova parella

5.2. Nombre de germans: _____

5.3. Posició que ocupa: _____

5.4. Amb qui viu el nen? _____

6. Antecedents mèdics

6.1. Pateix una malaltia crònica?

1. Si
2. No

6.2. Quina? _____

6.3. Ha estat mai hospitalitzat?

1. Si
2. No

6.4. Malalties rellevants: _____

6.5. Pren alguna medicació?

1. Si
2. No

6.6. Quina? _____

6.7. L'han operat mai?

1. Si
2. No

6.8. Proves complementaries i resultats:

6.9. Atribueix a alguna causa, l'estat actual del seu fill?

6.10. Té totes les vacunes?

1. Si
2. No

7. Alimentació

7.1. Al néixer va prendre alimentació:

1. Materna
2. Artificial
3. Mixta

7.2. Li va a costar agafar-se al pit?

1. Si
2. No

7.3. Duració alletament materna: _____

7.4. Perquè va a deixar l'alimentació materna:

1. Per feina
2. Dificultat en agafar-se al pit
3. Edat
4. Dificultats físiques de la mare

7.5. Actualment:

1. Menja tot
2. Fa selecció

7.6. Li costa mastegar?

1. Si
2. No

7.7. Intenta o menja sol?

1. Si
2. No

8. Son

8.1. Al néixer:

1. Dormia molt
2. Es despertava sovint

8.2. Costava consolar-lo?

1. Si
2. No

8.3. Actualment:

1. Dorm tota la nit seguida
2. Es desperta sovint
3. Té mals sons

8.4. Fan sempre el mateix ritual abans d'anar a dormir?

1. Si
2. No

8.5. Quin ritual és? _____

8.6. Quan es desperta a mitja nit és capaç d'adormir-se sol?

1. Si
2. No

9. Motricitat

9.1. A quina edat va caminar? _____

9.2. Va gatejar anteriorment?

1. Si
2. No

9.3. A quina edat va gatejar? _____

9.4. Puja escales sol?

1. Si
2. No

9.5. Baixa les escales sol?

1. Si
2. No

9.6. Consideres que el teu fill és àgil?

1. Si 2. No

9.7. Té noció del perill?

1. Si 2. No

9.8. Camina de forma particular (de puntetes, saltirons...)?

1. Si 2. No

10. Comunicació i llenguatge

10.1. Edat primer somriures: _____

10.2. Feia sons abans de l'any quan li parlaves?

1. Si 2. No

10.3. A quina edat va dir mama-papa amb significat? _____

10.4. Assenyala amb el dit el que vol o al que se li pregunta?

1. Si 2. No

10.5. Comunica amb gestos el que vol?

1. Si 2. No

10.6. Respon al que li preguntes?

1. Si 2. No

10.7. Xarloteja sense entendre'l?

1. Si 2. No

10.8. Comprèn el NO?

1. Si 2. No

10.9. Es gira al seu nom?

1. Si 2. No

11. Conducta

11.1. Té por a sorolls?

1. Si 2. No

11.2. Generalment està sol?

1. Si 2. No

11.3. Li costa els canvis de situacions i persones?

1. Si 2. No

11.4. Realitza conductes repetitives?

1. Si 2. No

11.5. Quines? _____

11.6. Li costa posar atenció en el joc?

1. Si 2. No

11.7. Té interès per joguines i els jocs?

1. Si 2. No

11.8. A què li agrada jugar? _____

11.9. Fa rodar els joguines?

1. Si 2. No

11.10. Plora quan el deixes sol?

1. Si 2. No

11.11. Accepta que li facis petons i abraçades?

1. Si 2. No

11.12. Busca i realitza de forma espontània fer petons i abraçades?

1. Si 2. No