

Psychomotor development disorders in apparently healthy children and considerations of family evaluation

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ABSTRACT

Difficulties that paediatricians find when evaluating psychomotor development at an early age result in the possibility that, at the school stage, seemingly healthy children can conceal development disorders, thereby complicating their detection, even within their own family environment. This study aimed to assess the prevalence of developmental disorders in children without a prior diagnosis and the consistency between family perception and the real state of development. 187 pupils (51.3% boys) with an average age of 4.3 years (DT = 1.2) took part in the study. The real state of psychomotor development was evaluated using the Battelle-2 Inventory, while family perception was assessed using the Age and Stages Questionnaires. Results revealed an average prevalence of 10% for impaired developmental, while 13.3% displayed delayed motor development. Regarding family perception, families attributed the above-average performance to their children in all aspects. Therefore, the level of correlation between family perception and real development was light in all the dimensions analysed. The results of this study emphasize the excessive number of children with developmental disorders that have gone undetected, as well as the limitations of evaluation tools for parents when used for children with no apparent risk.

Keywords: Motor development; Family perception; Evaluation; Battelle-2 developmental inventory; Age and Stages Questionnaires.

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INTRODUCTION

Psychomotor development (PD) is a gradual process determined by biological and cognitive aspects of social interaction and by the direct experience of learning processes (Vericat and Orden, 2010). Its disorders pose a significant issue, disrupting the health and quality of life for the children affected as well as their relatives. In order to ensure timely detection of possible risks or developmental deficits, the American Academy of Paediatrics (AAP) recommends a standardized evaluation routine for all healthy children at the ages of 9, 18 and 30 months (or 24 months) (American Academy of Paediatrics [AAP], 2006).

Paediatricians are considered to be suitable personnel for carrying out the PD (AAP, 2006; Bear, 2004) evaluations, nevertheless important barriers exist that limit its correct application, namely: a lack of time, a lack of resources and a lack of training in the use of the relevant tools (Sand et al., 2005; Sices et al., 2004). As a result, it has been found that only 15-20% of paediatricians use a standardised instrument to identify children with development difficulties, and 7 out of every 10 paediatricians admit to relying on their own judgment to detect the development disorders (Hamilton, 2006). At the same time, research has shown that paediatricians fail to detect more than 30% of PD disorders before school age (Boyle et al., 2012).

Children who have not been diagnosed begin their schooling without any type of special attention, which aggravates their issues (Garibotti et al., 2013). Consequently, most of children with developmental difficulties enrolled in infant education do not present obvious signs of illness, and the identification of these children becomes a challenge (Schonhaut et al., 2008). It has been suggested that the participation of families in the process of identification might have a positive impact at the initial detection stage (Jee et al., 2010; Sices et al., 2008). In order to facilitate the process of evaluation by parents, hardware has been designed based on parent perception, with a positive impact in terms of family participation (Schonhaut et al., 2013). Nevertheless, for a successful collaboration with relatives they must be articulate and able to use suitable procedures, since any perception error as either under- or over-valuation might have counter-productive effects (Silva et al., 2017).

The validity of parental perception has been investigated principally in older children and in samples with clear signs of developmental disorders. Nevertheless, until now, there have been no studies that analyse the efficacy of tools based on parental perception while studying apparently healthy 3-5-year-olds. In this context, it is possible that parents might demonstrate perception errors in the evaluation of the PD of their children, which might in turn have a negative impact on the evolution of their development.

The targets of the present study were: 1) to quantify the predominance within the group of development disorders which had not been previously detected by the paediatrician; 2) to determine the parental perception of their children's' psychomotor performance; 3) to analyse the degree of correlation between family perception and the real development level.

MATERIAL AND METHODS

Participants

A total of 187 children between 3 and 5 years old (51.3% boys and 48.7% girls) with an average age of 4.3 years (SD = 1.2) formed the sample of the present cross-sectional and descriptive study. When inviting the children to take part in the study, the aims were explained and all the necessary information and resources were made available. The verbal consent of each participant was provided.

The inclusion criteria were: having no diagnosed development disorder before schooling, having informed consent from the parents, and the participation of at least one parent in carrying out the questionnaire ASQ-3.

All the parents were informed about the aims and methodology of the study, with special attention to possible risks and inconveniences that it might cause, and their written assent was obtained. The present research was carried out in accordance with the WMA Declaration of Helsinki for research involving human subjects, and it was approved by the ethics committee of Padre Ossó Faculty (University of Oviedo).

Measures

Battelle Inventory (BDI)

For the analysis of the pupils' psychomotor profile, the Battelle Inventory was used in its 2nd edition in Spanish (Newborg, 2005). The test was applied screening for BDI-2 composed of 96 items grouped in 5 areas: motor, communicative, cognitive, social and adaptive.

In the shortened inventory, the items of the different areas correlate with the completed test above .96, except for the cognitive area in which the interrelation is .92; that is to say, the results perfectly predict the condition of the evaluated child (Newborg et al., 1996).

Age and Stages Questionnaires (ASQ-3)

The measurement of family perception of the relevant child's psychomotor development was carried out by means of the Age and Stages Questionnaires (ASQ-3). This questionnaire is most used in order to evaluate parents' perception of the psychomotor development of their children; it covers 5 areas: gross motor, fine motor, communication, social skills and problem solving. It was developed in the University of Oregon, and later translated and validated in Spain (Sarmiento Campos et al., 2011; Squires & Bricker, 2009) and more recently in Argentina (Romero Otalvaro et al., 2018).

The ASQ-3 registers a sensitivity of 86% and a specificity of 85%, guaranteeing its validity and reliability (Schonhaut & Armijo, 2014).

Procedures

Firstly, the parental perception of the children's psychomotor development was evaluated using ASQ-3, this was carried out within each child's school. Later, the state of the children's psychomotor development was evaluated by a therapist specialising in psychomotor activity and trained in BDI. This was carried out in a peaceful, distraction-free room specially adapted for the test, and located within each child's infant school. In order to facilitate the comparison between the two tests used, the method of domain grouping used by Simard et al. (2012) was employed to calculate the concurrent validity of the ASQ. Table 1 shows the relation between the areas evaluated by BDI and ASQ-3. At the same time, the present study uses three measurement thresholds: above expected, normal and below expected (Cueto et al., 2017).

Analysis

A descriptive analysis of the study variables was carried out. Following this, the assumed normality and/or homoscedasticity of the Shapiro-Wilk and Levene tests was verified. In those cases where these requisites were fulfilled, parametric tests were applied: T-Student or an analysis of factor variance. Otherwise, the corresponding non-parametric tests were selected: Mann-Whitney and Kruskal-Wallis. For the analysis of pairs in cases of statistically significant results, the Bonferroni test was applied.

Table 1. Relation between the different areas evaluated in this study using selected assessment tools, and the chosen nomenclature.

Study Nomenclature	Related areas for the assessment tools	
	BDI-2	ASQ-3
Motor	Motor	Gross Motor Fine Motor
Communication	Communication	Communication
Social	Personal / Social	Social-Individual
Cognitive	Cognitive Adaptive	Problem Solving

BDI-2: Batelle Inventory (2nd edition); ASQ-3: Age and Stages Questionnaires (3rd edition).

To measure the level of correlation between family perception of the child's PD and their real PD, Cohen's kappa coefficient was applied following the criteria established by Koch and Landis (1977).

The statistical analyses were carried out using SPSS program version 24.0 (IMB Corp, Armonk, NY). It established $p < .05$ as the value of significance for all the analyses.

RESULTS

Level of development and psychomotor profile

In the present study, the predominance of delayed psychomotor development in the motor area was established at 13.3% (evaluated as poor or very poor). In the areas of communication and cognition a large part of the sample displayed above-expected levels. Whereas at the social level, only 18.7% reached this standard (Table 2).

In the same way, the possible influence on the results of the following social-demographic variables was assessed; sex ($p = .41$), age ($p = .44$), place of residence ($p = .58$), number of brothers or sisters ($p = .40$) and the educational level of the father or mother ($p = .49$), and in none of these cases were there significant differences in the variables.

Table 2. Level of development in the different aspects of the Batelle Inventory. [Absolute frequency (relative frequency)].

Level of development	Areas of development			
	Motor	Communicative	Cognitive	Social
Below expected	25 (13.3)	16 (8.5)	11 (5.8)	23 (12.2)
Normal	87 (46.5)	86 (45.9)	78 (41.7)	129 (68.9)
Above expected	75 (40.1)	85 (45.4)	99 (52.9)	35 (18.7)

Familiar perception of the development of its children

Most of the families (72.1%) thought that their children possessed a motor development level above-expected for their age, as opposed to 22.9% who believed that they were within the normal parameters and 4.8% who thought their child was below expected levels.

The results indicated that most of parents (more than 75%) also thought that their children demonstrated above-expected levels in the communicative, cognitive and social areas (Table 3).

Table 3. Family perception of their children's development according to ASQ-3. [Absolute frequency (relative frequency)].

Level of development	Areas of development			
	Motor	Communicative	Cognitive	Social
Below expected	9 (4.8)	3 (1.6)	7 (3.7)	4 (2.1)
Normal	4 (22.9)	36 (19.2)	23 (12.2)	30 (16)
Above expected	135 (72.1)	148 (79.1)	157 (83.9)	153 (81.8)

ASQ-3: Age and Stages Questionnaires (3rd edition).

Correlation between family perception and the psychomotor profile of the study sample

In the area which displayed the greatest real regression (motor), only 48% of the parents evaluated their children correctly, which represents a degree of light concordance ($k = 0.06$) between the profile of the motor development of the children and their parents' perception (Table 4).

Table 4. Correlation between family perception and real motor development. [Absolute frequency (relative frequency)].

Motor development	Family Perception			
	Below expected	Normal	Above expected	Total
Below expected	6 (3.2)	7 (3.7)	12 (6.4)	25
Normal	2 (1)	23 (12.2)	62 (33.1)	87
Above expected	1 (0.5)	13 (6.9)	61 (32.6)	75
Total	9	43	135	187

$K = 0.06$

Light perception ($0.01 > k < 0.20$).

The degree of concordance was even less in the other aspects, although it remained within the parameters of light perception (Table 5).

Table 5. Correlation levels for family perception in the other aspects.

Kappa coefficient for each evaluated area		
Communicative	Cognitive	Social
0.04	0.04	0.01

Light perception ($0.01 > k < 0.20$).

DISCUSSION

In this study the psychomotor development level was verified in children who had not been previously diagnosed with development disorders, and then its degree of correlation was established in relation to the parents' estimates of the psychomotor performance of their children. The results of this study highlight an excess of undetected disorders, and reveals the limitations of evaluation tools for parents, especially when used for populations with no apparent risk of psychomotor retardation.

The present investigation reflected a prevalence in development disorders of 10%, highlighting motor retardation as problem area with 13.3% prevalence, placing it in line with previous research (Cano Cappelacci et al., 2014; Cueto et al., 2017). Regarding this point, it has been previously reported that this aspect is the one which paediatrician are less used to evaluating (Garibotti et al., 2013).

Cano Cappelacci et al. (2014) have pointed out that 12-16% of children and pre-school girls in developed countries present development disorders. Nevertheless, it is necessary to emphasize that in contrast to other research, the present study's sample did not include children who were previously diagnosed with development disorders by a paediatrician, granting even greater significance to the findings. Álvarez Gómez et al. (2009), in a longitudinal study of 6 years, found that of the children who were lacking risk factors and did not require a special follow up, 11.2% presented some type of developmental issue before 6 years of age, which reveals the importance of early diagnosis of these disorders and of continuing monitoring of psychomotor development in early ages, regardless of any absence of clear risk factors.

Therefore, family collaboration acquires an extra value. Recent studies have pointed out that parents can be reliable in their evaluations (Silva et al., 2017), likewise they have established that the ASQ is a precise tool to detect certain problems in seemingly healthy children (Plomgaard et al., 2006; Skellern et al., 2001). The results of this study indicate a few over-estimated evaluations of children throughout all the analysed aspects and this corresponds with the attitude of some parents who avoid recognising that their children could have a development problem, since a healthy child is a good indicator of their efforts as parents (Angarita et al., 2014). Nevertheless, this behaviour leads to incorrect evaluations on the part of the parents.

In the present study, the results indicated a significant perception error while assessing parents view of their children's development, highlighting a high index of overestimation across all aspects. Therefore, it must be regarded as significant that among the 25 children whose motor development was lower than expected, 19 (7%) were misevaluated by their family, who considered their development as normal or above-expected; a figure that is higher than those obtained in other studies (Plomgaard et al., 2006; Skellern et al., 2001). An explanation might be in the differences between the samples used by previous studies and the present. For example, in the previous studies the sample consisted of premature children whose evaluation was carried out in the first 48 months of life, while in the present study the seemingly healthy children were between 3 and 5 years of age. It is possible that the absence of previous indicators during the first 3 years of a child's development is one of the main reasons for the perception error. In this regard, it has been found that the parents achieve improved perception levels for disorders which have been previously diagnosed, and also when they take part in intervention programs (Hurley and Burt, 2015).

Regarding the level of correlation, it appears significant that low levels were obtained in each of the analysed areas. The present study demonstrated a level of light concordance in the motor area, nevertheless it was the area where the interrelation between the family perception and real development was strongest. Herranz Barbero et al. (2013) pointed out that families tend to estimate the physical aspects of the children more successfully than the social or emotional ones because these first characteristics are easily measurable. In our study, with regard to the motor area the greatest concordance was in those children who registered above-expected results. These results coincide with those obtained by a study that analysed the correlation between psychomotor development and the perception of teachers in infant education (Cueto et al., 2017).

The communicative, cognitive and social aspects demonstrated lower correlation levels than the motor area. The social area presented the most significant information. 81.8% of the parents considered their children above-expected, whereas only 18.7% really fell into this threshold. The parents perceive the sources of internal information based on opinions or experiences, considering them to be useful tools for the social evaluation of their children, therefore it is possible that a lower level of objectivity exists in their answers (Peet, 1995). On the other hand, the evaluation of motor or cognitive development, is considered to be the responsibility of the paediatrician. Furthermore, it has been suggested that one of the reasons that parents overestimate in ASQ questionnaires is that they do not address each section distinctly and tend to answer

each aspect within the same range (Simard et al., 2012). It is likely that parents require a certain kind of training which would allow them to better interpret these types of questionnaires.

The cross-sectional nature of this research imposes a limitation on this research as it prevents any study of causal relationships. At the same, the absence of any consideration of the parents' prior knowledge of the evaluation tool does not allow an objective view of this aspect. Therefore, longitudinal studies, especially through intervention, are necessary.

In addition to the existing need for early assessment of children's motor skills to detect possible developmental disorders, previous studies have shown that implementation of structured (Teixeira-Costa, Barcala-Furelos et al., 2015; Teixeira-Costa, Abelairas-Gómez et al., 2015) or moderate-to-vigorous (Piña-Díaz et al., 2020) physical education programs, improves the motor development process of pre-schoolers and therefore may help in reducing developmental disorders.

CONCLUSIONS

The high percentage of seemingly healthy children who displayed development disorders confirms the need for an early evaluation of their motor skills.

The light level of correlation between psychomotor development and parental perception across all aspects suggests that the review methods used by the parents, based on self-awareness or on their own intuition, can lead to a significant lack of accuracy, as a result of either conceptual confusion or the complexity of dealing with the relevant variables.

In any case, clearer and more precise measures are required in order that an objective assessment of the developmental levels of apparently healthy children can be made, as well as strategies for the training of families that could carry out such assessments.

AUTHOR CONTRIBUTIONS

All authors were involved in the design and methodology. JA-P and SC carried out the data collection. AC-F and CA-G performed the statistical analysis. JA-P wrote the original draft. CA-G revised the first version of the manuscript. All authors have reviewed, edited and agreed to the published this version of the manuscript.

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No potential conflict of interest was reported by the authors.

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