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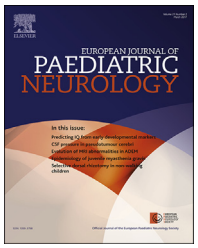

Original article

Can IQ predict parent-reported behavioral and emotional problems in children with neurological deficiencies?

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ABSTRACT

Objective: The aim of the current study was to investigate whether total intelligence scores (FSIQ) and/or a discrepancy in intelligence can predict behavioral or emotional problems in children with neurological deficiencies.

Method: The population consists of children with neurological deficiencies ($N = 610$, ranging from 6 to 17 years), referred due to concerns on the (educational) development of the child to a tertiary outpatient clinic. All children were tested with the Dutch Wechsler Intelligence Scale for Children – third edition (WISC-III-NL). A VIQ-PIQ discrepancy score was calculated by subtracting the performance capacities of the verbal capacities. The effects of demographic variables, FSIQ, and the VIQ-PIQ discrepancy on two parent-rated questionnaires measuring behavior and emotions in children were analyzed with linear and logistic regression models.

Results and conclusion: The VIQ-PIQ discrepancy was not predictive of behavioral or emotional problems recorded on the above-mentioned parent-rated questionnaires. The FSIQ score, age, and sex were predictive to some extent: increases in age and FSIQ led to a decrease of reported problems, and boys showed more problems than girls. Children with neurological deficiencies had on average significantly higher verbal capacities than performance capacities, in line with the neuropsychological principle that language survives brain damage whereas performance capacities are more affected.

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1. Introduction

The Wechsler intelligence scales, such as the WISC for children aged 6–17 years[31] and the WAIS for adults,[32] are the most frequently used assessment measurements of intellectual functioning for children worldwide.[23] Wechsler described intelligence as "the aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with the environment".[28] These Wechsler scales can be used to estimate this aggregate or global capacity of intelligence (Full Scale IQ; hereafter FSIQ), but also provide data on more specific cognitive abilities, such as the verbal reasoning abilities (Verbal IQ, hereafter VIQ) and nonverbal reasoning (Performance IQ, hereafter PIQ).[21,31] Factor analytic studies have repeatedly shown that VIQ and PIQ scores are two dissimilar functions with relatively low inter-correlations to one another (e.g., Refs. 18,31). When clinical psychologists use intelligence tests, such as the Wechsler's intelligence scales, they often aim to provide more insights in the capacities of the patient than just a general estimation of the FSIQ.[5] When a discrepancy between VIQ and PIQ is found for instance, it is common practice to explain the significance of this finding in terms of dysfunctioning. This is not surprising, since even Wechsler himself stated that "a difference of 15 points or more calls for further investigation",[30] and that this discrepancy is more commonly in pathological populations than in a healthy population.[29]

Research has shown that a discrepancy between VIQ and PIQ has been associated with neurological disorders in children (e.g., Refs. 7–9). The idea that there might be a relationship between a VIQ-PIQ discrepancy and neurological deficiencies dates back to the 1950's, when Andersen[2] observed a discrepancy between verbal and performance abilities in patients with lateralized brain lesions. The assumption was (and still is to some extent) that the verbal and performance scales of the Wechsler intelligence scales approximate measures of functions that are primarily lateralized in the two cerebral hemispheres. Lower VIQ compared to PIQ scores are assumed to be indicative of damage to the left hemisphere, whereas lower PIQ compared to VIQ scores are indicative of right hemisphere pathology.[4,9] However, opposite relations (e.g., VIQ > PIQ when lesion is present in the left hemisphere) also occur.[27] This is explained by the developmental principle of the crowding hypothesis: after an early insult in the left hemisphere, language is taken over by the right hemisphere resulting in a sparing of verbal functions. This results in lower nonverbal skills due to crowding in the right hemisphere.[27]

Besides the levels of each IQ index, and independent of the other IQ indices, it is assumed in clinical care that a VIQ-PIQ discrepancy also has a significant impact on daily functioning.[6] Children with a discrepancy in favor of performance capacities are hypothesized to have more difficulties in establishing social contacts or in explaining their feelings or worries, due to lower verbal capacities than performance capacities. Children with a contrary discrepancy might easily be overestimated on non-verbal cognitive functions since they are verbally strong(er). Therefore, the strength of the VIQ-PIQ discrepancy is believed to influence emotional and behavioral functioning. Overall, studies have found an inverse relationship between intelligence (i.e., FSIQ, VIQ, or PIQ) and emotional or behavioral problems in children.[26] When looking more specifically at the relation between VIQ-PIQ discrepancy and behavioral and emotional functioning, evidence showed that a VIQ-PIQ discrepancy in favor of the VIQ is related to depression in children with learning disabilities,[20] whereas the opposite discrepancy is related to externalizing behavioral problems in juveniles.[10] To our knowledge, no studies have been done on this relation in a population of children with neurological deficiencies. We believe however that it is important to examine this relationship in children with neurological deficiencies, since neurological lesions might result in a VIQ-PIQ discrepancy (as mentioned above). In the current study, it was examined to which extent FSIQ and the VIQ-PIQ discrepancy have an influence on emotional and behavioral functioning and thus can predict behavioral or emotional problems in children with neurological deficiencies. We hypothesize that children with a VIQ > PIQ discrepancy might have more internalizing problems, and children with a PIQ > VIQ discrepancy might experience more externalizing problems, in line with the studies mentioned above. It is important to examine this potential relationship, since it may give insights in treatment goals of the child and might be of influence on daily functioning.

2. Methods

2.1. *Participants*

Charts of 1077 children referred to the outpatient clinic of the Center for Neurological Disabilities in the period 2010–2016 were reviewed. The Center for Neurological Disabilities is a tertiary center for children with developmental or learning problems due to a neurological condition. The parents of a total of 40 children did not want to participate in this research, and thus these children were not included. Informed consents of all other children were acquired prior to reviewing the charts. All patients were screened by a team of a child neurologist and neuropsychologist. All children <6 years and >17 years were excluded since they were assessed with different intelligence tests than the WISC-III-NL, due to age limits of the WISC-III-NL. This resulted in a group of 610 children with neurological deficiencies (386 boys, 224 girls) with a mean age of 10.09 years ($SD = 2.75$), ranging from 6 to 17 years. All children were referred with learning or developmental problems due to their neurological deficiencies. Neurological diagnoses varied. The following diagnosis were prevalent in 10 or more children: neurofibromatosis ($N = 167$), traumatic brain injury ($N = 71$), neurological complications due to prematurity ($N = 43$), meningitis ($N = 23$), congenital cerebral malformations ($N = 22$), genetic/chromosome abnormality ($N = 19$), Duchenne Muscular Dystrophy ($N = 17$), specific language impairment ($N = 14$), cerebral palsy ($N = 13$), epilepsy ($N = 13$), migraine ($N = 11$), brain tumor ($N = 10$).

An overview of the intelligence profiles in the largest diagnosis groups can be found in Table 1. A total of 66 children