



# Seizure-related factors and non-verbal intelligence in children with epilepsy

## A population-based study from Western Norway

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### KEYWORDS

Epilepsy;  
Epidemiology;  
Seizure-related  
factors;  
Raven matrices;  
Children

### Summary

*Purpose:* To study the relationship between seizure-related factors, non-verbal intelligence, and socio-economic status (SES) in a population-based sample of children with epilepsy.

*Methods:* The latest ILAE International classifications of epileptic seizures and syndromes were used to classify seizure types and epileptic syndromes in all 6–12 year old children ( $N = 198$ ) with epilepsy in Hordaland County, Norway. The children had neuropsychiatric and EEG examinations. Of the 198 patients, demographic characteristics were collected on 183 who participated in psychological studies including Raven matrices. 126 healthy controls underwent the same testing. Severe non-verbal problems (SNVP) were defined as a Raven score at or <10th percentile.

*Results:* Children with epilepsy were highly over-represented in the lowest Raven percentile group, whereas controls were highly over-represented in the higher percentile groups. SNVP were present in 43% of children with epilepsy and 3% of controls. These problems were especially common in children with remote symptomatic epilepsy aetiology, undetermined epilepsy syndromes, myoclonic seizures, early seizure debut, high seizure frequency and in children with polytherapy. Seizure-related characteristics that were not usually associated with SNVP were idiopathic epilepsies, localization related (LR) cryptogenic epilepsies, absence and simple partial seizures, and a late debut of epilepsy. Adjusting for socio-economic status factors did not significantly change results.

*Conclusions:* In childhood epilepsy various seizure-related factors, but not SES factors, were associated with the presence or absence of SNVP. Such deficits may

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be especially common in children with remote symptomatic epilepsy aetiology and in complex and therapy resistant epilepsies. Low frequencies of SNVP may be found in children with idiopathic and LR cryptogenic epilepsy syndromes, simple partial or absence seizures and a late epilepsy debut. Our study contributes to an overall picture of cognitive function and its relation to central seizure characteristics in a childhood epilepsy population and can be useful for the follow-up team in developing therapy strategies that meet the individual needs of the child with epilepsy.

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## Introduction

Numerous studies of selected groups of children with epilepsy have demonstrated an association between epilepsy and cognitive deficits.<sup>1–6</sup> Some studies indicated that intelligence scores of children with epilepsy are in the normal range, tending to cluster towards the lower end, especially in symptomatic epilepsy.<sup>7–11</sup> According to Smith<sup>12</sup> and Meador<sup>13</sup> the majority of children with epilepsy show no cognitive impairment. In population-based studies of children with epilepsy, the frequency of mental retardation has been reported to be 24–41%.<sup>14–19</sup> Bourgeois et al.<sup>9</sup> argued that in childhood epilepsy, being a heterogeneous disorder, the reported average IQ scores are largely results of the samples studied.

In childhood epilepsy several seizure-related characteristics have been reported to be associated with impaired cognitive performance: non-controllable seizures or high seizure frequency, long duration and severe seizures, symptomatic aetiology, early onset of epilepsy and treatment related factors.<sup>9,13</sup> Atypical absences and other minor-motor seizures have also been found to be frequently associated with cognitive problems.<sup>8</sup>

There are several methodological problems when assessing the relationship between epilepsy and intellectual performance. Typical examples are inconsistencies in diagnosis and classification of epileptic syndromes, variability in classification of seizure types and other seizure-related factors, and insufficient use of control groups. In addition, potential confounding by socio-economic status (SES) factors has rarely been assessed and few studies have been population-based.

We have previously studied prevalence and medical aspects of childhood epilepsy in Western Norway.<sup>19</sup> In that study intelligence was assessed using WISC-R in patients, but control children without epilepsy were not included. Mental retardation (MR) defined as IQ < 70 was found in 39% of children. In the present study, the focus was not the frequency of MR, but whether various seizure-related characteristics are associated with increased frequency of cognitive problems. A robust measure of cognition, non-verbal reasoning

ability was assessed. To ensure a reliable estimate of the frequency of such cognitive problems, a population-based, controlled study design was chosen.

## Methods

### Population

The study population, including medical characteristics, has been previously described.<sup>19</sup> The study was conducted in Hordaland County in Western Norway. As of January 1, 1995, the county had 416,184 inhabitants (9.6% of the Norwegian population); 38,593 were born between January 1, 1982 and December 31, 1988 (information from Hordaland County Office 1995). Demographic characteristics of the county, such as average income and proportion of rural versus urban residence are similar to those of Norway as a whole. In Norway there are relatively small differences in socio-economic conditions and public access to health services.

### Case ascertainment

The only paediatric department in Hordaland County is situated at The University Hospital of Bergen. Nearly all children with active epilepsy in the county are treated and controlled by neuro-pediatricians working in this department. The only EEG laboratory in the county is also situated at The University Hospital. Children in Hordaland who have experienced at least two epileptic seizures are generally referred for EEG registration and a neuropaediatric examination. The following case identification methods were used: (a) review of hospital files of all patients aged 6–12 years with seizure disorders who had been examined in the paediatric department, (b) review of EEG files of all children in the specified age group registered at the EEG laboratory within the last 5 years, and (c) contact with the county's general practitioners, department of child psychiatry, special institutions for disabled children, and other hospitals in Hordaland and neighbouring counties.

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