



Academic and social success in adolescents with previous febrile seizures

Matti Sillanpää^{a,b,*}, Sakari Suominen^b, Päivi Rautava^c, Minna Aromaa^d

^aDepartment of Child Neurology, Turku, Finland

^bDepartment of Public Health, University of Turku, Turku, Finland

^cTurku University Hospital, Turku, Finland

^dTurku City Hospital, Turku, Finland

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ABSTRACT

Objective: To study academic achievement and social success in adolescents with febrile seizures (FS) before their 5th birthday.

Subjects and methods: A random birth cohort ($n = 900$) was prospectively followed from early pregnancy and examined at ages 12 and 18 years to study the relationships between FS and school achievement (three most important school marks), behavior and social competence (Achenbach Childhood Behavior Checklist, Youth Self-Report), life management (Antonovsky Sense of Coherence Scale) and social participation.

Results: No significant differences could be detected between children with vs. without FS or between boys vs. girls in academic achievement, behavior, social competence, life management, or social participation, either at age 12 or 18 years, except for more somatic complaints of girls at age 18. Of adolescents with previous FS, 29% had not participated in the maturity examination, 20% had participated but failed and 51% had passed, comparing 35%, 18% and 47%, respectively, of those without FS ($p = 0.6676$).

Conclusions: Our study confirms the findings of the previous population studies reporting similar academic and social success between children with and without febrile seizures before the 5th birthday. Reassurance of the parents about a favorable future may ameliorate their worries at this frightening event in their child's life.

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1. Introduction

Only a few population-based studies exist and they show no significant effect of FS on intelligence or academic performance.^{1–5} In an extensive 7-year follow-up study of approx. 54000 children,¹ no significant difference was found between children with vs. without FS in intelligence. At the age of 16 years, children with prior FS performed both academically and behaviorally as well as their peers.⁴ In another population survey⁵ of school-aged children, no significant association with FS could be found in academic performance or behavior. Assessment of cognitive abilities and school achievement after 12-year follow-up was normal in Danish children and did not differ between the two groups randomly allocated to intermittent prophylaxis (diazepam at fever) or no prophylaxis (diazepam at seizures) whether FS were simple or complicated.³ In a comparative study between children with FS vs. healthy controls, no significant neuropsychological

differences were found in short-term follow-up, but children with prolonged FS showed a significantly lower non-verbal intelligence as compared with controls or children who had simple FS.⁶

Few data exist on social competence associated with previous FS. Hutt et al.⁷ compared school-aged children who had FS before 4 years of age with their peers and found no significant difference in social adjustment. Working-class children, however, tended to be socially less well adjusted than their middle-class controls. There are no recent long-term studies on cognition and behavior following FS. The most parents whose child has had febrile seizures are often very concerned about the child's future health and risk for mental retardation, paralysis, physical disability and learning dysfunction.⁸ Our purpose was to study academic achievement and social success of a population-based cohort of children with febrile seizures before their 5th birthday in a prospective long-term follow-up setting.

2. Subjects and methods

2.1. Subject recruitment

A birth cohort sample was collected from a Finnish south-western province (total population 713,000) in 1986 using a

* Corresponding author at: Department of Public Health, University of Turku, 20014 Turku, Finland. Tel.: +358 2 333 7368; fax: +358 2 333 8439.

E-mail addresses: matsilla@utu.fi, matti.sillanpaa@utu.fi (M. Sillanpää).

stratified, randomized cluster sampling procedure. After standardization of the study area for socio-economic class, 11 of all 35 health authority areas as clusters, were randomly drawn for the study. The study population characteristics did not significantly differ from those in the province as a whole.⁹ The sampling area included 67 maternity care clinics and 72 well-infant clinics.

The initial cases were nulliparous women who were expecting their first child and had visited a public maternity health care clinic on their own initiative for the first time between January 1st, 1986 to December 31st, 1986. All of these women spoke Finnish or Swedish. In Finland, more than 99% of expectant mothers attend these clinics where they are followed throughout their pregnancy.¹⁰ Staff doctors and nurses at these clinics were specifically educated about the study and approached all the eligible women. Ninety-one percent ($n = 1443$) of those eligible agreed to participate and the total sample comprised 1294 newborns who all were mentally normal ($IQ > 70$). At age 18 years, the check-up covered 787 (78%) of 1003 families who had been followed up to the age of five years. The study design has previously been reported in detail.^{9,11,12}

2.2. Dropout analysis

Table 1 shows the flow chart and number of dropouts during the different stages of the follow-up. The only data available about 139 of 1582 mothers who declined to enter the study indicated that their occupations did not differ from those who gave informed consent ($p = 0.27$). Of 1443 families who gave informed consent, 149 further families failed to participate. They included 72 families with spontaneous or induced abortion, 17 with multiple births or stillbirth, 8 with relocation abroad or in Finland, 9 with unacceptably or defectively completed forms, and 43 who refused to participate. Thus, 1294 children were included in the follow-up study. One child died at age 9 years.

At age of 12, 900 (70%) and at age 18, 787 (61%) of 1294 children participated the follow-up examination. Dropout analysis was made between the 787 participants and 507 dropouts. A selection bias might be assumed between the participants and dropouts considering the low retention rate during 18-year follow-up. Dropouts might be expected to be poorer learners than the participants. Therefore, we focussed on academic achievement of the participants and nonparticipants. In Finland, one of the best available measure of academic achievement is passing the maturity examination, usually at age 18 years. Passing the Finnish national written matriculation examination is the basis of starting university studies. The requirement level of the matriculation examination is comparable with that of the US matriculation examination plus one year of university.¹³ The comparison did not show any significant difference ($p = 0.6676$) between the participants and dropouts with regard to not participating to, participating to, or participating and passing the examination (29%, 20%, 51% respective 35%, 18%, 47%; $p = 0.6676$) which argues against selection bias.

Table 1
Subject participation (N) in the follow-up examinations.

Time point of check-up	Eligible	Participants	Dropouts
10th week of pregnancy	1582	1443	139
28th week of pregnancy	1443	1294	149
Delivery	1294	1247	47
3 months	1247	1216	31
9 months	1216	1111	105
18 months	1111	1025	86
3 years	1025	887	138
5 years	1025	1003	22
7 years	1003	881	22
12 years	1003	908	95
16 years	908	857	51
18 years	857	787	70

2.3. Methods

In the course of prospective follow up examinations (Table 1), data were collected about medical and social aspects of health including FS and recurrent unprovoked seizures by means of posted questionnaires for mothers and fathers and for children 12 years or older. In addition, notes made by the designated physician and nurse in the well-infant clinic were available up to school age. Additional data were obtained, throughout the study, from diaries completed online by the parents and data from children's well-baby clinics.

Febrile seizures were defined as ones diagnosed contemporarily by doctor.¹¹ Children who had one or more FS until their 5th birthday (later referred to as previous FS) were considered as cases. FS at age less than 4 weeks were excluded. Febrile status epilepticus was defined as seizure lasting 30 min or more. Seizures were considered recurrent if they were two or more with a 24 h or longer interval.

Academic achievement was assessed at age 12 and 18 years by the class teacher who rated the school marks (scale from 4 to 10) of native language, best foreign language, and mathematics, determined by the national Board of Education of Finland as the most important and illustrative subjects (www.oph.fi). In Finland, the native language is Finnish in approx. 94%, Swedish in about 5%, and another language (mostly English, German, French, or Spanish) in the remaining 1%. At age 18 years, language-based achievement was assessed using the data from the national Finnish written matriculation examination (National Central Statistics Bureau files 2004). The registry covers all the students who have participated the matriculation examination. This examination is designed measure knowledge, skills and maturity required by the curriculum for the upper secondary school.

Behavior and social competence was assessed using the Achenbach Child Behavior Checklist (CBCL) for 12–18-year-olds completed by the parents and the Youth Self-Report (YSR) by the children.¹⁴ The CBCL consists of two major scales: a social competence scale (including the areas of social activities, social tasks and school competence) and behavioral problem scale scored as continuous variables. The lower scores reflect fewer problems.

Life management was measured by the Antonovsky sense of coherence scale.^{15,16} Sense of coherence is characterized as an individual's readiness to deal with every day life stress. In a previous study, based on the same data as the present study,¹⁶ the sense of coherence was shown to be reasonably stable from 15 to 18 years of age. Furthermore, life management was assessed by participation in social life including teams, clubs, bands, choirs, associations and similar activities. Social relations considered relationships with peers, siblings, parents, teachers and other adults.

2.4. Statistical analysis

For pairwise comparisons, chi square test and Fisher exact test (two-tail) when appropriate, *t*-test, were applied. For multivariate analysis, stepwise logistic regression analysis was used.

The study was approved by the Joint Ethics Review Committee of the University of Turku Medical School and the University of Turku Central Hospital.

3. Results

3.1. Background factors

In our prospective population study, 58 (6.4%) of 900 children had one or more previous febrile seizures (FS). Compared with families whose child had not had any previous FS, mothers with FS

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