ABSTRACT

Objectives. To investigate the association between learning difficulties (LDs) and behavioural and emotional problems of 8-year-old children in the Northern Finland Birth Cohort 1986 (n=9432).

Study design. A cross-sectional study.

Methods. Teachers assessed children's behaviour with a Rutter scale (RB2) and assessed their learning with questions about whether a child had difficulties in reading, spelling and mathematics.

Results. Of the children, 21.4% (n=1774) had 1 or more learning difficulties (LDs): 12.3% (n=1026) had a verbal LD, 3.0% (n=248) a mathematical LD and 6.0% (n=500) a combined LD. For boys with LDs, an adjusted odds ratio of having behavioural problems was 3.1 (95% CI 2.5–4.0) and emotional problems 3.0 (2.0–4.6), and for girls 3.9 (2.6–5.8) and 5.3 (3.6–8.1), respectively. In boys and girls, verbal difficulties were associated with behavioural and emotional problems whereas mathematical difficulties were associated with behavioural problems in boys and with emotional problems in girls. Divorced and reconstructed family types were significant risk factors for LDs and behavioural problems, whereas a lifelong one-parent family type was a risk factor for behavioural problems, but not for LDs. A child's younger age compared to that of classmates, a mother's and a father's low education level and a low family SES were risk factors for having LDs.

Conclusion. More attention should be paid to children whose families are facing adverse circumstances, especially as it affects their preschool education, in order to support their learning and school attendance.

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Keywords: learning difficulties (LDs), emotional and behavioural problems, comorbidity, motor development, family structure, mother's and father's education, socio-economic status (SES)
INTRODUCTION

In Finland in 2001, 21.2% of the school-aged children were referred to special education because of learning difficulties and, in 2004, the figure was 28% (1). The percentage is similar to that of other Western countries (2), but higher figures have also been presented. For instance, in a comprehensive follow-up study from Australia in 1994, 36.6% of the primary and secondary school children were identified as having some area of special learning needs in their first school year, and by 1996, it had dropped to 33.3% (3). Moreover, a large, National Survey of Children's Health (NSCH) from the year 2003 in the U.S., concerning the lifetime prevalence of learning disabilities and special health care needs of children under 18 years of age, indicated the life time prevalence to be 9.7% and, depending of the number of definitional criteria (from 1 to 5), the prevalence of learning disabilities ranged from 15.0% to 87.8% (4).

Learning disabilities are often associated with different co-morbidities, for instance, problems in motor development as well as emotional and behavioural problems (5). These disabilities can occur alone or in varying combinations and can range from mild to severe. The prevalence of children's emotional and behavioural problems have been reported to range from 5% to 20%, being more common among boys than girls (6–9) and, the association between learning disabilities and emotional and behavioural problems has been indicated in many previous studies (3,10–15). They have also been found to be more persistent when they co-occur with behaviour problems in the early school years compared to learning disabilities occurring alone (10,11,13,16,17). Behavioural problems at 5 years of age related to speech/language and developmental delays seem to be good predictors of later learning disabilities (12,18,19).

In many studies male gender, low socio-economic status (SES), family structure, the mother's and father's low educational levels (3,15,17,20–24) and poor motor skills have been found to be risk factors for learning disabilities (8). In their study, Zubrick et al. (8), for instance, indicated that children whose language emerged late had statistically significantly more gross and fine motor problems than those whose language developed within a normal range. Yliherva et al. (23) and Viholainen et al. (25) have also suggested that motor development has an impact on later language development. While the impact is mainly on learning language, it can also affect reading, spelling and mathmatic learning skills in children who are at risk of having familial dyslexia or preterm children who are at risk of having learning disabilities.

According to the International Classification of Diseases (5), which is commonly used in Finland, basic learning disability is defined as emerging in reading, writing and/or mathematics, even though the cognitive skills of these children are within normal range. In the research and literature, many different terms have been used to describe academic difficulties, such as, learning disability, learning deficit, learning dysfunction, learning delay and learning disorder. Even though the same term can be used to describe different kinds and different levels of learning difficulties, Carlson (26), for instance differentiates between the terms learning difficulty and learning disability. According to her, an individual with a learning difficulty can learn in a classroom where the teacher uses conventional teaching techniques while an individual with a learning disability requires specialized interventions, depending on the type of disability.

In this study we use the term learning difficulties (LDs). We do so for two reasons: first, because this was an epidemiological study where we could only screen children's learning difficulties by
Learning difficulties and problem behaviour

Teaching difficulties and problem behaviour

The main purpose of the study was to determine the association between LDs (in reading, spelling and mathematics) and emotional and behavioural problems in 8-year-old children. We studied some risk factors related to LDs, such as fine and gross motor skills and socio-economic status (SES), family structure and the mother’s and father’s levels of education, as well as gender differences in LDs and in behavioural and emotional problems.

MATERIAL AND METHODS

Population

Our study is based on an unselected, population-based cohort called the Northern Finland Birth Cohort 1986. The original study population consisted of 9,432 live-born children, whose dates of birth were between 1 July 1985 and 30 June 1986 (27). All the mothers living in the 2 northernmost provinces of Finland, Oulu and Lapland were recruited and 99% participated. At the time of the follow-up, when the children were 7 and 8 years old, 99% (n=9357) of them were alive and most of them (98%) were receiving a conventional education (7). For this study, children with intellectual disabilities (n=74) were excluded.

The ethical committee of Northern Ostrobotnia Hospital District approved the study.

The follow-up study of the cohort was carried out when the children were 7 and 8 years old. In the autumn of the children’s first school year, information on their growth, development and health, school and family type and social situation was gathered from the parents by mailing them a questionnaire (response rate n=8416, 90%). In the spring, teachers were asked to screen the children’s learning difficulties and behaviour problems (response rate n=8525, 92%) and the parents filled in a questionnaire on the children’s psychomotor development (response rate n=8370, 90%). The more detailed description of the data collection has been presented elsewhere (7).

Definition of the variables

Learning difficulties

Teachers assessed the children’s potential learning difficulties during the current term by answering the question, “Has a child got difficulties in learning (a) to read, (b) to spell, (c) mathematics: yes or no?” For the analysis, we created 3 main variables: (1) verbal difficulty (VLD), (2) mathematical difficulty (MLD) and (3) combined difficulty (CLD). VLD included reading or spelling or both, and CLD included mathematical and reading, mathematical and spelling, or all three difficulties.

Behavioural (BP) and emotional (EP) problems

Children’s emotional and behavioural problems were assessed using information obtained from teachers. The Rutter Child Behaviour Questionnaire for Teachers (RB2) includes 26 items producing a total score from 0 to 52 (28). According to the RB2, children with a total score of 9 or more are designated as having a probable psychiatric disorder. Of the children with a score 9 or more, those with an emotional subscore (based on 4 items – is worried, afraid of new things, is often in tears, seems often unhappy or anguished – for a maximum score of 8 points) higher than the behavioural subscore are designated as “children with emotional problems.” Those with a behavioural subscore (based on 6 items – frequently fights, steals, teases others, lies,
disobeys, destroys property – for a maximum score of 12 points) higher than the emotional subscore are designated as “children with behavioural problems.” The children with equal emotional and behavioural subscores were excluded in the analyses because of the small number of cases (1.1%, n=92) (7). For the emotional and behavioural subscores, the inclusion criterion was 3 out of 4 and 5 out of 6 items, respectively. The RB2 scale was developed to help teachers to evaluate children’s behavioural and emotional problems. The reliability of the scale has been reported to be high (28,29), and the scale has been used and validated in many population-based studies in Finland (e.g., 6,30).

**Problems with fine and gross motor skills**

Parents reported their children’s fine and gross motor skills. They were asked, “Is your child’s penmanship awkward?” (answer choices: yes [1], no [2], cannot say [3]); “Does your child bump or fall down often?” (yes [1], no [2], cannot say [3]); “Can your child usually catch the ball in the game?” (mostly [1], sometimes [2], hardly ever [3]); “Can your child (a) drive a two-wheel bike, (b) skate, (c) tie his/her shoelaces?” (yes [1], no [2], not experimented [3]); “Can your child use scissors?” (yes [1], no [2]). A child was identified as having problems with fine motor skills if the parents thought that their child’s penmanship was awkward, the child could not tie his/her shoelaces or the child could not use scissors. Problems with gross motor skills included the child’s having frequent bumps or falls, hardly ever succeeding in catching the ball in a game or being unable to ride a two-wheel bike or to skate.

**Family characteristics and social status**

Information about a family’s type, socio-economic status (SES) and the mother’s and father’s education were obtained from the parents’ questionnaires. The variable family type was divided into 4 different subtypes: (1) biological 2-parent family; (2) divorced family; (3) reconstructed family; and (4) life-long 1-parent family. The family’s SES was based on the father’s occupation and, when not available (e.g., in the case of a single-mother family), on the mother’s occupation, and was classified into (1) professionals; (2) skilled workers; (3) unskilled workers; and (4) farmers. The mothers’ and fathers’ education levels were classified into (1) basic (less than 10 years of education); (2) secondary (10–12 years of education); and (3) tertiary (more than 12 years of education).

**Statistical analyses**

Pearson’s chi-square test was used for comparing gender differences in LDs and behavioural problems. Univariate and multivariate logistic regression analyses were used to explore the associations between covariates, LDs and behavioural problems. Covariates used in the analyses were known risk factors: the child’s age and sex, his/her mother’s and father’s education, SES and family structure, as well as the child’s fine and gross motor skills. Analyses were performed for all the children together and stratified by sex. First, the associations between the covariates and LDs/behavioural problems were studied by conducting separate univariate logistic regression models for each of the covariates using LD/behavioural problems as the outcome. Then, the association between LDs and behavioural problems were studied by using behavioural problems as the outcomes and LDs as a predictor. The analyses were performed unadjusted and adjusted for all of the covariates. The associations are reported in odds ratios (OR) with their 95% confidence intervals (CI). Statistical analyses were conducted with SAS 9.1.
RESULTS

In our sample, 1,774 (21.4%) children had 1 or more learning difficulties (VLDs, MLDs or CLDs). On the whole, LDs were more common among boys than girls, with the exception of MLDs, which were observed more frequently in girls. VLDs (12.3%) occurred more often than MLDs or CLDs, and the combination of reading and spelling difficulties was more prevalent than reading or spelling difficulties alone. The girls usually had only 1 learning difficulty, while the boys had 2 (Table I). The boys had more behavioural problems than the girls (Table II). Related to the learning difficulties, behavioural problems were the most prominent in the boys with LDs and emotional problems in the girls with LDs (Fig. 1). There were more LDs (25.1% vs. 17.6%) and more behavioural (10.6% vs. 7.5%) and emotional (5.3% vs. 2.7%) problems among children born in 1985 than among those born in 1986, that is, more problems among those who were born during the end of the year and were thus the youngest ones in their class at school. These differences were statistically significant (Tables III and IV).

The problems in motor functions, especially in fine motors skills, were associated with LDs as well as behavioural and emotional problems. The girls with poorly developed fine motor skills more commonly had LDs (OR 5.3, 95% CI 3.4–8.3) (Table III) and also behavioural (3.7, 1.8–7.7) and emotional (3.2, 1.4–7.1) problems (Table IV). For the boys, the corresponding figures were 2.6 (2.2–3.2) for LDs (Table III), 1.9 (1.5–2.4) for behavioural problems and 2.3 (1.6–3.3) for emotional problems (Table IV). Also, difficulties in gross motor skills were significantly associated with the

| Table I. Proportions of teacher-reported learning difficulties (LDs) in 8-year-old children. |
| --- |
| **Type (of LDs)** | Boys | Girls | All |
| **Verbal** | n (%) | n (%) | n (%) <br>χ² (p-value) |
| Reading | 698 (16.4) | 328 (8.0) | 1026 (12.3) | 135.3 (<0.0001) |
| Spelling | 53 (1.2) | 37 (0.9) | 90 (1.1) | 2.3 (0.13) |
| Reading & spelling | 260 (6.1) | 144 (3.5) | 404 (4.8) | 30.4 (<0.0001) |
| **Mathematical** | n (%) | n (%) | n (%) <br>χ² (p-value) |
| Mathematical & reading | 105 (2.5) | 143 (3.5) | 248 (3.0) | 7.5 (0.01) |
| Mathematical & spelling | 283 (6.6) | 217 (5.3) | 500 (6.0) | 6.6 (0.01) |
| Mathematical & reading & spelling | 6 (0.1) | 9 (0.2) | 15 (0.2) | 0.7 (0.39) |
| **Combined** | n (%) | n (%) | n (%) <br>χ² (p-value) |
| Mathematical & reading | 53 (1.2) | 42 (1.0) | 95 (1.1) | 0.9 (0.35) |
| Mathematical & spelling | 224 (5.2) | 166 (4.0) | 390 (4.7) | 7.1 (0.01) |
| Mathematical & reading & spelling | 418 (9.9) | 324 (8.0) | 742 (8.9) | 9.8 (0.002) |
| **Total** | n (%) | n (%) | n (%) <br>χ² (p-value) |
| (verbal + mathematical + combined) | 1086 (25.7) | 688 (16.9) | 1774 (21.4) | 96.9 (<0.0001) |

*Pearson’s χ²-test for pair wise comparisons between boys and girls.

| Table II. Proportions of behavioural and emotional problems in 8-year-old children. |
| --- |
| **Type of behavioural problem** | Boys | Girls | All | χ² (p-value)* |
| Behavioural | 597 (13.9) | 163 (4.1) | 760 (9.1) | 253.3 (<0.0001) |
| Emotional | 176 (4.1) | 158 (3.8) | 334 (4.0) | 0.4 (0.53) |

*Pearson’s χ²-test for pair wise comparisons between boys and girls.
Table III. The association between background factors and learning difficulties in the first grade at school.

|                      | Boys (n=4219) Learning difficulties | Girls (n=4077) Learning difficulties | All (n=8296) Learning difficulties |
|----------------------|-------------------------------------|--------------------------------------|------------------------------------|
|                      | Total n %                            | n OR (95% CI)                        | Total n %                            | n OR (95% CI)                        | Total n %                            | n OR (95% CI)                        |
| **Year of birth**    |                                     |                                     |                                     |                                     |                                     |                                     |
| July 1–Dec. 31, 1985 (younger in the classroom) | 2083 29.9 623 1.5 (1.3-1.8) | 2071 20.3 421 1.7 (1.4-2.0) | 4154 25.1 1044 1.6 (1.4-1.7) |
| Jan 1–June 30, 1986 (older) | 2136 21.7 463 Ref. | 2006 13.3 267 Ref. | 4142 17.6 730 Ref. |
| **Problems with motor skills** |                                     |                                     |                                     |                                     |                                     |                                     |
| Fine motor skills    |                                     |                                     |                                     |                                     |                                     |                                     |
| No                   | 3169 21.3 676 Ref.                  | 3772 15.6 588 Ref.                  | 6941 18.2 1264 Ref.                  |
| Yes                  | 581 41.6 242 2.6 (2.2-3.2)          | 77 49.4 38 5.3 (3.4-8.3)            | 658 42.6 280 3.3 (2.8-3.9)          |
| Gross motor skills   |                                     |                                     |                                     |                                     |                                     |                                     |
| No                   | 3729 24.5 913 Ref.                  | 353 16.1 603 Ref.                  | 7492 20.3 1516 Ref.                  |
| Yes                  | 222 33.3 74 1.5 (1.2-2.1)           | 114 25.4 29 1.8 (1.2-2.7)           | 336 30.7 103 1.7 (1.4-2.2)           |
| **Family structure** |                                     |                                     |                                     |                                     |                                     |                                     |
| Always 2-parent family | 3273 23.7 776 Ref.               | 3149 15.0 473 Ref.               | 6422 19.4 1249 Ref.               |
| Divorced family      | 252 31.0 78 1.4 (1.1-1.9)          | 229 21.0 48 1.5 (1.1-2.1)         | 481 26.2 126 1.5 (1.2-1.8)         |
| Reconstructed family | 256 32.6 82 1.5 (1.2-2.0)          | 259 20.8 54 1.5 (1.1-2.0)         | 515 26.4 136 1.5 (1.2-1.8)         |
| Lifelong 1-parent family | 43 32.6 14 1.6 (0.8-3.0)          | 67 17.9 12 1.2 (0.7-2.3)         | 110 23.6 26 1.3 (0.8-2.0)         |
| **Family SES**       |                                     |                                     |                                     |                                     |                                     |                                     |
| Professional         | 1537 19.4 298 Ref.                  | 1463 11.8 (173) Ref.               | 3000 15.7 471 Ref.                  |
| Skilled worker       | 1639 28.0 459 1.6 (1.4-1.9)        | 1602 18.2 (291) 1.7 (1.4-2.0)     | 3241 23.1 750 1.6 (1.4-1.8)        |
| Unskilled worker     | 281 34.2 96 2.2 (1.6-2.9)           | 281 22.8 (64) 2.2 (1.6-3.0)       | 562 28.5 160 2.1 (1.7-2.6)         |
| Farmer               | 297 26.9 80 1.5 (1.2-2.0)           | 288 18.1 (52) 1.6 (1.2-2.3)       | 585 22.6 132 1.6 (1.3-1.9)         |
| **Mother’s education** |                                     |                                     |                                     |                                     |                                     |                                     |
| Tertiary             | 1012 15.8 160 Ref.                  | 1093 10.0 (109) Ref.               | 2105 12.8 269 Ref.                  |
| Secondary            | 2150 26.8 576 2.0 (1.6-2.4)         | 1966 18.4 (362) 2.0 (1.6-2.6)      | 4116 22.8 938 2.0 (1.7-2.3)        |
| Basic                | 632 33.5 212 2.7 (2.1-3.4)          | 629 18.1 (114) 2.0 (1.5-2.7)       | 1261 25.9 326 2.4 (2.0-2.8)        |
| **Father’s education** |                                     |                                     |                                     |                                     |                                     |                                     |
| Tertiary             | 661 15.4 102 Ref.                   | 646 7.9 (51) Ref.                  | 1307 11.7 153 Ref.                  |
| Secondary            | 2150 23.1 497 1.6 (1.3-2.1)         | 2081 16.8 (349) 2.4 (1.7-3.2)      | 4231 20.0 846 1.9 (1.6-2.3)        |
| Basic                | 912 36.2 330 3.1 (2.4-4.0)          | 872 18.2 (159) 2.6 (1.9-3.6)       | 489 27.4 489 2.8 (2.3-3.5)        |

*In Finland, children start school in the year they turn 7. The children born between the dates 1 July 1985 and 31 December 1985 started school in the autumn of 1992. The children born between the dates 1 January 1986 and 30 June 1986 started school in the autumn of 1993. Consequently, the children born in the beginning of the year are older than their classmates born in the autumn or the winter.*
Table IV. The association between background factors and behavioural (BP) and emotional (EP) problems in the first grade at school.

|                                | Boys (n=4295) |                                        | Girls (n=4115) |                                        | All (n=8410) |                                        |
|--------------------------------|---------------|----------------------------------------|----------------|----------------------------------------|--------------|----------------------------------------|
|                                | Total         | OR (95% CI)                            | Total          | OR (95% CI)                            | Total        | OR (95% CI)                            |
|                                | n             | %                                      | n              | %                                      | n            | %                                      |
|                                |               |                                        |                |                                        |              |                                        |
| **Year of birth**              |               |                                        |                |                                        |              |                                        |
| 1 July–31 Dec. 1985 (younger   | 2138          | 16.4                                   | 2089           | 4.6                                    | 4227         | 10.6                                   |
| in the classroom)              |               | 1.6 (1.3, 1.9)                         | 1.4 (1.1, 2.0) | 5.1                                    | 1.5 (1.3, 1.8) | 2.1 (1.7, 2.7)                      |
| 1 Jan.–30 June 1986 (older)    | 2157          | 11.5                                   | 2026           | 3.3                                    | 4183         | 7.5                                    |
|                                |               | Ref                                    | Ref            |                                        | Ref          |                                        |
| **Problems with motor skills** |               |                                        |                |                                        |              |                                        |
| Fine motor skills              |               |                                        |                |                                        |              |                                        |
| No                             | 3211          | 11.8                                   | 3807           | 3.7                                    | 7018         | 3.4                                    |
| Yes                            | 605           | 19.3                                   | 77             | 11.7                                   | 682          | 18.5                                   |
|                                |               | 1.9 (1.5, 2.4)                         | 3.7 (1.8, 7.7) | 9.1                                    | 3.2 (1.4, 7.1)| 2.7 (1.8, 3.4)                      |
| Gross motor skills             |               |                                        |                |                                        |              |                                        |
| No                             | 3789          | 12.8                                   | 3878           | 3.8                                    | 7576         | 3.6                                    |
| Yes                            | 229           | 18.3                                   | 116            | 6.9                                    | 345          | 14.5                                   |
|                                |               | 1.6 (1.1, 2.3)                         | 2.0 (0.9, 4.1) | 6.0                                    | 1.9 (0.9, 4.1)| 3.6 (1.2, 7.7)                      |
| **Family structure**           |               |                                        |                |                                        |              |                                        |
| Always two parent family       | 3333          | 11.6                                   | 3176           | 3.2                                    | 6509         | 3.5                                    |
| Divorced family                | 257           | 20.6                                   | 229            | 7.9                                    | 486          | 14.6                                   |
|                                |               | 2.1 (1.6, 3.0)                         | 2.7 (1.6, 4.7) | 6.6                                    | 2.2 (1.2, 3.8)| 2.3 (1.3, 3.3)                      |
| Reconstructed family           | 259           | 23.6                                   | 262            | 7.6                                    | 521          | 15.4                                   |
|                                |               | 2.4 (1.8, 3.3)                         | 2.4 (1.4, 4.0) | 3.4                                    | 2.3 (1.7, 2.9)| 3.3 (1.0, 6.7)                      |
| Lifelong one parent family     | 44            | 27.3                                   | 67             | 11.9                                   | 111          | 18.0                                   |
|                                |               | 3.0 (1.5, 5.9)                         | 4.7 (2.2, 10.2)| 11.9                                   | 3.0 (1.8, 4.9)| 9.9 (1.8, 6.7)                      |
| **Family SES**                 |               |                                        |                |                                        |              |                                        |
| Professional                   | 1557          | 11.2                                   | 1472           | 2.9                                    | 3029         | 2.9                                    |
| Skilled worker                 | 1670          | 14.7                                   | 1616           | 4.6                                    | 3286         | 4.0                                    |
|                                |               | 1.4 (1.1, 1.7)                         | 1.6 (1.1, 2.4) | 4.2                                    | 1.5 (1.0, 2.3)| 1.4 (1.1, 1.9)                      |
| Unskilled worker               | 291           | 17.9                                   | 284            | 3.2                                    | 575          | 6.3                                    |
|                                |               | 1.8 (1.3, 2.5)                         | 1.1 (0.6, 2.4) | 7.0                                    | 1.6 (1.2, 2.2)| 2.3 (1.6, 3.5)                      |
| Farmer                         | 303           | 10.2                                   | 293            | 3.8                                    | 596          | 7.1                                    |
|                                |               | 0.9 (0.6, 1.4)                         | 1.3 (0.7, 2.5) | 2.4                                    | 1.0 (0.7, 1.4)| 1.3 (0.8, 2.0)                      |
| **Mother’s education**         |               |                                        |                |                                        |              |                                        |
| Tertiary                       | 1029          | 10.5                                   | 1099           | 3.6                                    | 2128         | 6.9                                    |
| Secondary                      | 2180          | 13.8                                   | 1979           | 3.4                                    | 4159         | 8.9                                    |
|                                |               | 1.4 (1.1, 1.8)                         | 1.0 (0.7, 1.5) | 4.2                                    | 1.6 (1.0, 2.4)| 1.3 (1.1, 1.6)                      |
| Basic                          | 654           | 15.6                                   | 641            | 6.1                                    | 1295         | 10.9                                   |
|                                |               | 1.6 (1.2, 2.1)                         | 1.8 (1.1, 2.8) | 3.6                                    | 1.7 (1.3, 2.1)| 3.5 (0.9, 1.9)                      |
| **Father’s education**         |               |                                        |                |                                        |              |                                        |
| Tertiary                       | 664           | 10.5                                   | 647            | 2.6                                    | 1311         | 6.6                                    |
| Secondary                      | 2191          | 12.5                                   | 2105           | 3.8                                    | 4296         | 8.2                                    |
|                                |               | 1.2 (0.9-1.6)                          | 1.4 (0.9-2.5)  | 3.1                                    | 1.0 (0.6-1.7)| 1.3 (1.0-1.6)                      |
| Basic                          | 934           | 15.5                                   | 879            | 4.4                                    | 1813         | 10.2                                   |
|                                |               | 1.6 (1.2-2.2)                          | 1.8 (1.0-3.2)  | 4.9                                    | 1.7 (1.0-2.9)| 5.0 (1.3-2.8)                      |
occurrence of LDs and behavioural problems in the boys. For the girls, difficulties in gross motor skills were associated significantly with LDs, but not with behavioural or emotional problems.

The children living in a biological 2-parent family had the fewest LDs and behavioural and emotional problems (Tables III and IV). The divorced and reconstructed family types were statistically significant risk factors for LDs, whereas a lifelong 1-parent family was not. On the other hand, a lifelong 1-parent family was a statistically significant risk factor for behavioural problems in boys and for behavioural and emotional problems in girls. For both genders, the lower socio-economic status of the family and the mothers’ lower education seemed to be risk factors for the children's LDs as well as problems with their behaviour. However, it seems that, for both genders, the fathers’ basic level of education more so than the mothers’ basic level of education had an even stronger association with the children’s learning difficulties (all: OR 2.8, 95% CI 2.3–3.5 vs. OR 2.4, 95% CI 2.0–2.8, Table III) and emotional problems (all: OR 1.9, 95% CI 1.3–2.8 vs. OR 1.3, 95% CI 0.9–1.9, Table IV).

![Figure 1](image1.png)

**Figure 1.** Proportion (%) of behavioural (BP) and emotional (EP) problems of children with and without learning difficulties (LDs).

![Figure 2](image2.png)

**Figure 2.** An unadjusted and adjusted odds ratio of a child with learning difficulties to have concurrent behavioural or emotional problems (boys and girls together).
Learning difficulties and problem behaviour

Having LDs was a risk factor for having simultaneous behavioural and emotional problems, even when adjusted for other background factors (Fig. 2). As seen in Table V, LDs were a substantial risk factor especially for emotional problems (5.3-fold odds for girls and 3.0-fold for boys), even when adjusted for the child's age, socio-economic status of the family, mother's and father's education, family structure and fine and gross motor skills.

Among boys and girls, CLDs comprised the highest risk for all types of problems in behaviour. For boys with CLDs, the odds for behavioural problems were 4.4 (95% CI 4.5–5.7), and for emotional problems 4.6 (2.6–8.1). Among the boys, verbal and mathematical difficulties were associated with behavioural problems, whereas among the girls, verbal and mathematical difficulties were associated with emotional problems.

Our study showed that for boys, the association between LDs and behavioural and emotional problems was quite similar (OR 3.1 vs. 3.0), for girls emotional problems were more prominent (OR 5.3 vs. 3.9), but it is worth noting that the confidence intervals overlap (Table V). For the whole group with LDs, the adjusted odds ratios (95% CI) were 4.0 for emotional problems and 3.3 for behavioural problems.

### Table V. Unadjusted and adjusted odds ratios (OR) with 95% confidence intervals (CI) for behavioural and emotional problems by learning difficulties (LDs), separately in boys and girls.

|                | No behavioural disorder | Behavioural problems | Emotional problems |
|----------------|-------------------------|----------------------|-------------------|
|                | Unadjusted OR  (95% CI) | Adjusted OR  (95% CI) | Unadjusted OR  (95% CI) | Adjusted OR  (95% CI) |
| **Boys**       |                         |                      |                   |
| LD             |                         |                      |                   |
| No             | 2692 (86.2)             | 312 (10.0)           | Ref.             | Ref.             |
| Yes            | 711 (67.5)              | 263 (24.3)           | 3.2 (2.7–3.8)    | 3.1 (2.5–4.0)    |
| **Type of LD** |                         |                      |                   |
| Verbal         | 504 (72.3)              | 137 (19.7)           | 1.8 (1.4–2.2)    | 1.7 (1.3–2.2)    |
| Mathematical   | 69 (66.4)               | 26 (25.0)            | 2.3 (1.4–3.6)    | 2.5 (1.5–4.3)    |
| Combined       | 138 (49.1)              | 100 (35.6)           | 4.9 (3.7–6.4)    | 4.4 (3.0–6.2)    |
| **Girls**      |                         |                      |                   |
| LD             |                         |                      |                   |
| No             | 3181 (94.3)             | 99 (2.9)             | Ref.             | Ref.             |
| Yes            | 540 (78.8)              | 59 (8.6)             | 3.5 (2.5–4.9)    | 3.9 (2.6–5.8)    |
| **Type of LD** |                         |                      |                   |
| Verbal         | 273 (84.0)              | 23 (7.1)             | 2.1 (1.3–3.3)    | 2.5 (1.4–4.2)    |
| Mathematical   | 116 (81.1)              | 6 (4.2)              | 1.2 (0.5–2.8)    | 1.0 (0.4–3.0)    |
| Combined       | 151 (69.6)              | 30 (13.8)            | 5.4 (3.5–8.4)    | 5.2 (3.1–8.9)    |

**Adjusted for child's age, socio-economic status of the family, mother's and father's education, family structure, fine and gross motor skills.**

**The OR for each type of the LD is referred to the group without the learning difficulty in question.**

**Verbal=reading, spelling and reading & spelling together.**

**Combined=mathematical & reading or mathematical & spelling or all 3 difficulties.**
DISCUSSION

In our study, children with learning difficulties had behavioural or emotional problems more commonly than children without LDs. This association between LDs and behaviour was independent of sociodemographic background factors. The overlap between LDs and behavioural and emotional problems has been shown in many previous studies (10,14,17,31–33), but there are relatively few studies that examine the association between LDs and emotional problems (16,31,32). Our study showed that for boys, the association between LDs and behavioural and emotional problems was quite similar, but for girls, emotional problems were more prominent, even though the confidence intervals of the estimates overlapped (Table V). For the whole group with LDs, the adjusted odds were 3.3 for behavioural problems and 4.0 for emotional problems (Figure 2).

Previous research has focused primarily on reading LDs, apparently because they occur more frequently, while mathematical LDs have received little attention (11,36). In our study, having mathematical LDs was found to be a somewhat higher risk factor for emotional problems than verbal LDs in girls but not in boys, whereas combined LDs had the highest odds for emotional problems both in boys and girls. Our results were in accordance with Prior et al. (11), who highlighted the association between emotional problems and mathematical difficulties at the preadolescent stage, especially among girls. Problems in mathematics are usually considered to be more common among girls than boys, and separate from verbal difficulties (37).

In our study, the poor development of motor skills, especially fine motor skills, was related to LDs. This result is in line with previous studies (8,23,25), but contradictory results have also been reported. For example, Shapiro et al. (38) indicated that reading delay is better predicted using infant language measures than using measures of early motor development.

Children who lived in a biological 2-parent family had the lowest odds for LDs and also for behavioural and emotional problems compared to other family types. Divorced and reconstructed family types were associated with behavioural problems, but only divorced family types were significantly associated with emotional problems. A lifelong 1-parent family did not represent a statistically significant risk factor for LDs, whereas associations with behavioural and emotional problems existed, especially for girls (Table III and IV). Also, studies by Altarac and Saroha (4) and Kiernan and Mensah (39) have indicated that neither single-mother families nor 2-parent families with biological parents were statistically significant risk factors for LDs.

Instead, in several studies (40–42), a low SES and the mother’s low educational level have been shown to be significant risk factors for LDs and also for emotional and behavioural problems. In our study, the father’s basic level of education turned out to have an even stronger association with a child’s LDs and emotional problems. Also, some other studies (15,20,22,24) have indicated the importance of the father’s education to a child’s academic achievements, even though the mother’s contribution has been considered more important. The parents’ occupation and education may reflect their attitudes towards schooling, their support for pre-reading and reading skills and resources available for children. Parents in high SES families are able to give to their children a more stimulating home environment and offer them more support in developing their academic skills (10,43).

Studies have shown that there is an association between a family’s environment and socio-
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economic status and a child’s weak performance level, which means that more attention should be paid to support children from low SES families. These studies (39,44) have indicated that persistent poverty, low family income, the parents’ unemployment and poor maternal care are strong predictors of lower scores in communication, language, literacy and mathematics for children, especially for boys. The early identification of children with special educational needs is important in supporting them to reach their full potential in education. Other studies have shown (45,46) that this can be done, for instance, by strengthening preschool education. However, Melhuish et al. (47) indicated that even though such family factors as parents’ education and SES are important, the quality and extent of home learning activities and home environment have a greater and independent influence on a child’s academic achievement. Also, Belsky et al. (48) showed that the quality of parenting preschool-aged children proved to be a stronger and more consistent predictor of children’s developmental outcomes and school achievement when tested among 5th graders than did any of the other child-care predictors. Parallel results have been presented in other studies (42,49).

Strengths and weaknesses

Our large homogenous population-based study provides a high degree of reliability in studying the prevalence and types of LDs among children who also have behavioural problems. According to the study by Anders et al. (50), teachers were found to be good in evaluating children’s special needs in reading and mathematics, even though it has been reported that teachers may over estimate children’s problems (51) and that many different factors affect teacher’s assessments (46). In evaluating behavioural and emotional problems, the Rutter Scale (RB2) was used. It has been developed for teachers to evaluate children’s behavioural and emotional problems. The scale is suitable for screening populations and its the reliability and validity have been reported to be high (28,29), and the scale has been used and validated in many population-based studies in Finland (e.g. 6,30). Of course, the assessment of these things is difficult and there is always a question of which comes first: Are LDs caused by behavioural and/or emotional problems, or are behavioural and/or emotional problems caused by LDs? Emotional and behavioural problems hinder concentration and learning, whereas learning problems affect self-confidence and may lead to difficulties, which in children are often manifested as behavioural difficulties and/or emotional problems.

One of the weaknesses in this study was the fact that we only relied on 1 informant instead of on several informants (e.g., parents), which would have strengthened the results. Another weakness was the fact that at the time of the evaluation, children were finishing their first school year and it might have been too early to screen children for learning difficulties that could develop as they mature. However, generally teachers are typically responsible for comparing and reporting students’ classroom difficulties, which makes their perspectives more objective than that of the parents. Another weakness was the screening instrument we used to determine LDs. In many studies with a small sample size, different kinds of measures, like neuropsychological measures and standardized achievement tests, have been used and issues such as IQs and the early history of language development have been taken into account. It was not possible for us to use these measurements because of the epidemiological nature of our study.
Conclusions

LDs among children are often associated with problems in their behaviour, and this is why these problems should be taken into account, for example, in remedial instruction as well as in general education. Attention should be focused on less recognized emotional problems that seem to be strongly connected to LDs, especially mathematical LDs among girls. A family's structure, the parents' SES and their education levels can affect a child's school achievement as well as the child's learning difficulties and behavioural and emotional problems. Thus, co-operation between the home and the school is extremely important. More attention should be paid to children from low SES families, especially their preschool education and its long-term effects, so that these children can receive as much support as possible for their learning and for attending school.

REFERENCES

1. Mannerkoski M, Heiskala H, Autti T. Oppimisvaikeudet ja kehitysvammairuiset kouluissa: epidemiologinen näkökulma [Learning difficulties and intellectual disability at school age: epidemiological point of view]. Duo decim 2006;122(15):1897–1902. [In Finnish]
2. Avchen RN, Scott KG, Mason CA. Birth weight and school-age disabilities: a population-based study. Am J Epidemiol 2001;154(10):895–901.
3. Mcleod S, Mckinnon DH. Prevalence of communication disorders compared with other learning needs in 14,500 primary and secondary school students. Int J Lang Commun Disord 2007;42(S1):37–59.
4. Altarac M, Saroha MA. Life-time prevalence of learning disability among U.S. children. Pediatrics 2007;119(Suppl):S77–S83.
5. World Health Organization. International Statistical Classification of Diseases and Related Health Problems [Internet]: 10th Revision. Version for 2007 [cited 2010 Oct 3]. Available from: http://www.who.int/classifications/apps/icd/icd10online/
6. Almqvist F, Kumpulainen K, Ilkäheimo K, Linna S-L, Henttonen I, Huikko E, et al. Behavioural and emotional symptoms in 8–9-year-old children. Eur Child Adolesc Psychiatry 1999;8(Suppl 4):7–16.
7. Taanila A, Ebeling H, Kotima A, Moilanen I, Järvelin M-R. Is a large family a protective factor against behavioural and emotional problems at the age of 8 years? Acta Paediatr 2004;93(4):508–517.
8. Zubrick SR, Taylor CL, Rice ML, Slegers DW. Late language emergence at 24 months: an epidemiological study of prevalence, predictors, and covariates. J Speech Lang Hear Res 2007;50(6):1562–1592.
9. Bos SC, Gomes A, Clemente V, Marques M, Pereira AT, Maia B, et al. Sleep and behavioral/emotional problems in children: a population-based study. Sleep Med 2009;10(1):66–74.
10. Sanson A, Prior M, Smart D. Reading disabilities with and without behaviour problems at 7–8 years: prediction from longitudinal data from infancy to 6 years. J Child Psychol Psychiatry 1996;37(5):529–541.
11. Prior M, Smart D, Sanson A, Oberklaid F. Relationships between learning difficulties and psychological problems in preadolescent children from a longitudinal sample. J Am Acad Child Adolesc Psychiatry 1999;38(4):429–436.
12. Tomblin JB, Zhang X, Buckwalter P, Cats H. The association of reading disability, behavioural disorders, and language impairment among second-grade children. J Child Psychol Psychiatry 2000;41(4):473–482.
13. Heiervang E, Stevenson J, Lund J, Hugdahl K. Behaviour problems in children with dyslexia. Nord J Psychiatry 2001;55(4):251–256.
14. Yu JW, Buka SL, McCormick MC, Fitzmaurice GM. Indurkhy A. Behavioural problems and the effects of early intervention on eight-year-old children with learning disabilities. Matern Child Health J 2006;10(4):329–338.
15. Khamis V. Classroom environment as a predictor of behavior disorders among children with learning disabilities in the UAE. In: Garner JB, Christiansen TC, editors. Social Sciences in Health Care and Medicine. New York: Nova Science Publishers; 2008. p. 1–10.
16. Beitchman JH, Youn AR. Learning disorders with a special emphasis on reading disorders: a review of the past 10 years. J Am Acad Child Adolesc Psychiatry 1997;36(8):1020–1032.
17. Kumpulainen K, Räsänen E, Henttonen I, Puura K, Moilanen I, Piha J, et al. Psychiatric disorders, performance level at school and special education at early elementary school age. Eur Child Adolesc Psychiatry 1999;8(4):48–54.
18. Hille ET, den Ouden AL, Bauer L, van den Oudenrijn C, Brand R, Verloove-Vanhoorick SP. School performance at nine years of age in very premature and very low birth weight infants: perinatal risk factors and predictors at five years of age. Collaborative Project on Preterm and Small for Gestational Age (POPS) Infants in the Netherlands. J Pediatr 1994;125(3):426–434.
19. Beitchman JH, Wilson B, Brownlie EB, Walters H, Lannecy W. Long-term consistency in speech/language profiles: I. Development and academic outcomes. J Am Acad Child Adolesc Psychiatry 1996;35(6):804–814.
20. Tomblin JB, Smith E, Xhang X. Epidemiology of specific language impairment: prenatal and perinatal risk factors. J Commun Disord 1997;30(4):325–344.
21. Hollohan HA, Dobbins DR, Scott KG. The effect of biological and social risk factors on special education placement: birth weight and maternal education as an example. Res Dev Disabil 1998;19(3):281–294.
22. Weinrich D, Jennen-Steinmetz C, Laucht M, Eßer G, Schmidt MH. Epidemiology and prognosis of specific disorders of language and scholastic skills. Eur Child Adolesc Psychiatry 2000;9(3):186–194.
23. Yliherva A, Olsen P, Mäki-Torkko E, Koiranen M, Järvelin M-R. Linguistic and motor abilities of low-birthweight children as assessed by parents and teachers at 8 years of age. Acta Paediatr 2001;90(12):1440–1449.

24. Choudhury N, Benasich AA. A family aggregation study: the influence of family history and other risk factors on language development. J Speech Lang Hear Res 2003;46(2):261–272.

25. Viholainen H, Ahonen T, Lytinen P, Cantell M, Tolvanen A, Lytinen H. Early motor development and later language and reading skills in children at risk of familial dyslexia. Dev Med Child Neurol 2006;48(5):367–373.

26. Carlson S. A two-hundred-year history of learning disabilities [Internet]. Education Resources Information Center, Online submission; 2005 [cited 3 Oct 2010]. Available from: http://eric.ed.gov/ERICWebPortal/detail?id=ED490746.

27. Jarvelin M-R, Hartikainen-Sorri A-L, Rantakallio P. Labour induction policy in hospitals of different levels of specialization. Br J Obstet Gynaecol 1993;100(4):310–315.

28. Rutter M. The children’s behaviour questionnaire for completion by teachers: preliminary findings. J Child Psychol Psychiatry 1967;8(1):1–11.

29. Elander J, Rutter M. Use and development of the Rutter behaviour questionnaire. Br J Educ Psychol 1992;62:127–143.

30. Linna S-L, Moilanen I. The Finnish national epidemiological study of child psychiatric disorders: results from prevalence screening in Northern Finland. Arctic Med Res 1994;53(Suppl 1):7–11.

31. Hinshaw SP. Externallyizing behavior problems and academic underachievement in childhood and adolescence: Causal relationships and underlying mechanisms. Psychol Bull 1992;111(1):127–155.

32. Willcutt E, Pennington B. Comorbidity of reading disability and attention-deficit/hyperactivity disorder: differences by gender and subtype. J Learn Disabil 2000;33(2):179–191.

33. Barkley RA, Shelton TL, Crosswait C, Moorehouse M, Fletcher K, Barrett S, et al. Preschool children with disruptive behavior: three-year outcome as a function of adaptive disability. Dev Psychopathol 2002;14(1):45–67.

34. Rousseau C, Drapeau A, Corin E. School performance and emotional problems in refugee children. Am J Orthopsychiatry 1996;66(2):239–251.

35. Halonen A, Aunola K, Ahonen T, Nurmi J-E. The role of learning to read in the development of problem behaviour: a cross-lagged longitudinal study. Br J Educ Psychol 2006;76(Pt 3):517–534.

36. Rourke BP, Fuerst DR. Psychological dimensions of learning disability subtypes. Assessment 1996;3(3):277–290.

37. Jordan NC, Hanich LB, Kaplan D. Arithmetic fact mastery in young children: a longitudinal investigation. J Exp Child Psychol 2003;85(2):103–119.

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