The prevalence of SDQ-measured mental health problems at age 5-7 years and identification of predictors from birth to preschool age in a Danish birth cohort: The Copenhagen Child Cohort 2000

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Title

The prevalence of SDQ-measured mental health problems at age 5-7 years and identification of predictors from birth to preschool age in a Danish birth cohort: The Copenhagen Child Cohort 2000

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Abstract

Objective: To investigate the prevalence, distribution and predictors of mental health problems in 5-7 year old Danish children in the general population.

Material and methods: This study is a 5-7 year follow-up study of a birth cohort of 6,090 children, the Copenhagen Child Cohort 2000.The extended version of the Strengths and Difficulties Questionnaire (SDQ) was answered by parents and pre-school teachers. Data from Danish national registers included perinatal data, socioeconomic data and data on child mental illness diagnosed at hospital in preschool age.

Results: Register data from the first year of life was obtained from 99.7% of the children in the cohort. Of 5,898 eligible children, 3,501 participated in the SDQ assessment (59%). The overall estimated 6-month prevalence of mental health problems was 4.8% (95% CI: 4.1-5.6). Conduct problems were found in 3.0% (95%CI: 2.4-3.6), problems of hyperactivity/inattention in 0.7% (95%CI: 0.4-1.0) and emotional problems in 1.5% (95%CI: 1.1-1.9).

Boys showed a higher risk of having mental health problems compared to girls: risk ratio 2.0 (95%CI 1.5-2.8). Several markers of socioeconomic disadvantages were associated with mental health problems at 5-7 years of age.

Conclusions: The 6-month prevalence of SDQ-measured mental health problems was relatively low in Danish children when compared with findings from several European countries, but were in line with findings from other studies in Nordic countries. The lower prevalence might reflect differences in in psycho-social risk load and environmental stress given the social and cultural context.

Background

Psychiatric disorders with their origin in childhood are considerable contributors to the global burden of diseases [1], and half of all lifetime cases of any psychiatric disorder seem to have their beginning before the age of 15 years [2]. Data from longitudinal studies point to the persistency of psychopathology from childhood through pre-adolescence and adolescence although the individual symptom patterns seem to change over time [3-6].

Epidemiological data on the frequency and distribution of mental health problems at different ages in childhood are essential for service planning and prevention and futhermore as a useful first step in the investigation of the significance of psychopathology in childhood [1;3].

Standardized measures are essential to ensure the validity of case-definition and to facilitate comparison of child mental health problems and risk factors across countries and over time [1;3;7]. The Strengths and Difficulties Questionnaire, SDQ, is a standardized questionnaire used to assess mental health problems and resultant impairment in children and adolescents. It was developed and evaluated in Great Britain [8-11] and extensive use and evaluation in many countries and different cultures has increased its usefulness for comparisons between countries [7;12;13].

Prevalence studies using the SDQ have found functionally impairing psychopathology in 10-15% of 5-15 year olds children and adolescents [14;15]. The patterns of mental health problems vary across cultures and over time [3;4;6;15] Relatively lower scores of SDQ-measured problems have been found in children from Nordic countries in contrast to other industrialized countries [13;15;16].

The Copenhagen Child Cohort 2000 (CCC2000) is a prospective study of mental health problems and psychopathology in a Danish birth cohort.. The overall aim of the CCC2000 is to study the presentation, developmental pathways and risk mechanisms of psychopathology longitudinally from birth [17].

The present study is a follow-up of CCC2000 to estimate the 6-month prevalence, distribution and comorbidity of SDQ-measured mental health problems in children aged 5-7 year An additional aim was to investigate possible predictors of mental health problems of this age . Information on putative risk factors was obtained from Danish National Registers.

Methods

Study population

The Copenhagen Child Cohort 2000, CCC2000 is a birth cohort that consists of all children born in 16 municipalities in the county of Copenhagen in a one-year period from 1st of January to 31st of December 2000, comprising a total of 6,090 children. Children not living in Denmark at the time of the investigation were excluded. There was no other criteria for exclusion.

The CCC2000 covers 9% of children born in Denmark during the year 2000 and is representative of the general population of Danish children born that year with regard to the distribution of gender and birth parameters. The methodology of the CCC2000 baseline study cohort has been described in more detail elsewhere [17].

Recruitment

Information about the child and current place of residence for this wave of the study was obtained from the Danish Civil Register. Out of 6,090 children, 6072 (99.7%) children could be identified in the Danish National Registers (18 children (0.3%) died before they could enter the follow-up study). A total of 174 children were not eligible for the SDQ investigation: 136 (0.2%) lived abroad, 29 (0.5%) had no known address and 9 (0.1%) were missing from the Danish Civil Register. Thus, a total of 5,898 (97%) children were eligible for the SDQ investigation at the 5-7 year follow-up. The study was carried out from August 2005 to April 2007. The parents were mailed an invitation letter with information about the study and were asked to complete and return an enclosed copy of the SDQ. In addition, parents were asked to relay an SDQ to the child's pre-school teacher as well. A reminder was mailed after 3 weeks to parents who had not responded. The parents and pre-school teachers returned their questionnaires separately.

Parents who had problems answering the questionnaire because of difficulties with the Danish language were offered help with the translation of the questions.

Instrument

Mental health problems were measured by the Strengths and Difficulties Questionnaire, SDQ, which is a 25 item screening questionnaire in which parents and pre-school teachers report on how the child has been in the past 6-months [8;9;11]. The items are divided in five scales of five items, each, generating scores for emotional symptoms, conduct

problems, hyperactivity/inattention, peer relationship problems, and pro-social behaviour. The five scales are each scored from 0-10 and classified as "normal", "borderline", or "abnormal".

A total difficulties score is calculated as the sum of scores of the conduct, hyperactivity, emotional and peer problems scales [8;18]. The extended version of the SDQ used in this study includes questions on whether the respondent believes that the child "had difficulties in one or more of the following areas: emotions, concentration, behaviour or being able to get along with other people". If a problem is reported, the respondent is asked additional questions about distress, social impairment, burden and chronicity [9].

A computerised algorithm brings together the answers from parents and pre-school teachers on symptoms and impact to estimate the probability of mental health problems [10;14;19]. The algorithm makes separate predictions of conduct-oppositional problems, hyperactivity-inattention problems and emotional problems and generates an overall prediction regarding probable, possible or unlikely mental health problems [10]. In summary, the algorithm predicts disorders on the basis of the combination of high symptom and impact scores. Probable conduct-oppositional and emotional disorders can be predicted on the basis of high symptoms and impact reported by just one respondent (since these disorders can be situational). Conversely, a probable hyperactivity-inattention disorder is only predicted when there is supporting evidence from both the parent and preschool teacher (since ADHD and hyperkinesis are expected to be pervasive across situations).

Using this algorithm to combine data from different informants has been shown to identify psychiatric diagnoses in children with a specificity of 80-95%, a sensitivity of 63%-85% and the positive and negative predictive value of respectively 54% and 96% in a general population [10]. The SDQ has been used in both industrialized counties and in less developed countries [19], suggesting that the questionnaire can be used in different cultural settings.

The SDQ has been translated into Danish and used in general population studies of Danish children, however with no available psychometric data [20].

Since the transition from preschool to school does not happen until the age of 7 in Denmark, a few SDQ questions were modified, substituting "kindergarten" for "school", and "pre-school teacher" instead of teacher".

(For further information, see www.sdqinfo.com.)

In this study children were defined as having impairing mental health problems if they were classified as having "probable" mental health problems by the SDQ algorithm; they are contrasted with the rest of the sample who were classified by the algorithm as having "unlikely" or "possible" mental health problems. Mental health problems are

further described using the total difficulties score and specific SDQ symptom and impact scores, all generated using standard procedures [8;9;18].

Register data

Data from Danish National Registers were used for attrition analysis and to obtain data on perinatal adversities and putative psycho-social risk factors.

In Denmark, all citizens have a unique personal identification number which follows the person through out life. The personal ID number is used by all central registers and authorities including the health care system. Furthermore, it is possible to obtain valid information on the socioeconomic status of the parents of each individual child.

Data from the Medical Birth Register included birth weight, gestational age, apgar score (a method of evaluating the physical condition of a newborn infant shortly after delivery. Normal apgare score is 10), birth complications and serious malformation. Data on hospital admissions included diagnoses on mental health disorders (ICD-10 F-diagnoses) obtained from the National Patient Register and the Psychiatric Central Register. Data on socio-economic variables in the family were obtained from Integrated Database for Labour Market Research. Overall, data on 99.7% of the birth cohort were obtained via these registers.

Ethics

The project was approved by the Scientific Ethics Committee of Copenhagen County (KA-05103) and the Danish Data Protection Agency (2007-41-1361).

Statistical analysis

The chi square test was used to evaluate differences between groups. Prevalence estimates were given with 95% confidence intervals (CI). A weighting procedure based on direct standardization [21] was applied to take account of the way in which responders differed from the target population in health and socioeconomic risk factors.

For example, a weighted estimate of the prevalence of mental health problems in the sample studied (responders) assuming the same gender distribution as in the entire sample (including both responders and non-responders).

Test of Marginal Homogeneity was used for analyses of the differences in SDQ scores categorized as normal, borderline and abnormal in children with 2 informants.

Because of non-homogeneity of variances, the Wilcoxon Signed Rank test was used to investigate the differences in median SDQ symptom scores derived from parent and pre-school teachers.

Kappa coefficients were calculated to investigate the agreement in SDQ symptom scores between parents and pre-school teachers.

Children with "probable" mental health problems as predicted by the SDQ algorithm were compared on perinatal adversities and socioeconomic risk factors with children where mental health problems were predicted to be "possible" or "unlikely". Subsequently, predicted mental health problems were dichotomised as probable or not (i.e. combining "possible" and "unlikely") and multivariate logistic regression was performed, including independent variables which were found to be associated with mental health problems in univariate analyses (p<0.1). The multiple logistic regression analysis estimated the independent effect of the variables while controlling for effect of child gender and maternal age. Differences in mental health problems by gender and by the number of SDQ informants are reported as risk ratio, RR with 95% CI.

Statistics were performed with the statistical program SAS, version 9.2 (SAS Institute Inc, Cary, NC, USA)

Results

Of 5,898 children eligible for the SDQ study, questionnaires were completed on a total of 3,501 (59%). Parent

questionnaires were obtained on 3,349 children (57%) and pre-school teacher questionnaires on 2,594 children (44%).

Questionnaires from both parents and pre-school teachers were obtained on 2,442 children (41%). Information from

parents only was available on 907 children; and information from pre-school teachers only was available on 152

children. The gender distribution was 1,775 (51%) boys and 1,726 (49 %) girls. The mean age (SD) was 5.4 (0.3).

Table 1 shows background characteristics of the CCC 2000 cohort. The following characteristics were over-represented

among non-responders: parents who were not born in Denmark; low household income; younger mothers; low maternal

education; parents living separately at the time of birth; and changed family composition in the first 5 years of life.

No differences in the distribution of perinatal adversities were found, except for a small, but statistically significant

difference in mean birth weight (3,535 grams in children with SDQ data as compared with 3,449 grams in non-

participants).

Table 1 about here

Prevalence of mental health problems

The 6-month prevalence of mental health problems predicted by the SDQ algorithm is shown in table 2. Among the

3,501 participants, 168 were classified as having mental health problems, which corresponds to an overall 6-month

prevalence estimate of 4.8% for participants. A further 513 children (14.7%) were classified as "possible" cases and

2,781 (79.4%) children were classified as "unlikely."

The analyses were repeated using weights to adjust for differential non-response, with only a slight increase in

estimated 6-month prevalence from 4.8% to 5.0% (95%CI 4.2-5.8). The weighting procedure is described in the section

on statistical analysis.

Among the different types of mental health problems, conduct problems were the most common, found in 3%, followed

by. emotional problems, found in 1.5%, and hyperactivity/inattention in 0.7%. Boys were at a higher risk of having at

least one mental health problem as compared to girls: RR 2.0 and at a significantly higher risk in all types of mental

health problems except for emotional problems.

Table 3 shows a comparison of parent and pre-school teacher ratings in the 2,442 children with information from both a parent and a pre-school teacher. Among these children, 3.6% (N=88) had a total difficulties score in the abnormal range as judged by parent report, but significantly more children, namely 5.9 % (N=143), had abnormal scores as judged by pre-school teacher report (table 3). When looking at measures of impact, a total of 114 children (4.8 %) had an abnormal impact score according to their parent report, whereas 147 children (6.2%) had an abnormal impact according to their preschool teacher report. The most common mental health problems reported by parents were emotional problems (7.4% in abnormal range), whereas problems of hyperactivity/ inattention were the most common reported by pre-school teachers (9.0% in abnormal range). The agreement of parents and the pre-school teachers in their reports on child mental health problems was in general low, as indicated by a Kappa value ranging from 0.09 to 0.29 Children with information from preschool teachers only were more likely to have an abnormal high total difficulties score compared to children with SDQ completed by both parents and pre-school teachers: RR 3.2 (95%CI 2.2-4.7). However, no difference in risk was seen regarding children with parent reports only.

There was no significant difference in gender for children with missing reports from parents and the preschool teacher.

Co-occurrence of mental health problems at child age 5-7 years

Among children with mental health problems, 7% had overlap across two main SDQ subgroups, primarily due to the co-occurrence of conduct problems in more than a third of the children with hyperactivity/inattention problems. (figure 1).

Predictors of mental health problems at 5-7 years

Table 4 shows perinatal and socioeconomic variables associated mental health problems in children aged 5-7 years. The only significant child-related factors were being a boy and having been diagnosed at hospital with a mental health

disorder in the first four years of life. No significant associations were found with regard to markers of perinatal adversities or illness..

Socioeconomic factors significantly associated with mental health problems at 5-7 years were immigrant parents, teenage mothers, less educated mothers, lower household income, parents living separately at the time of the birth, and the child being exposed to changes in family composition in their first 5 years of life No significant association was found with regard to paternal age, parity at birth, the social status of the living areas at birth.

Table 4 about here

All variables significantly (p=<0.1) associated with mental health problems (p<0.1) were included in multivariate models (logistic regression) adjusted for gender and maternal age (table 5). Male gender was the only characteristics of the child that was significantly and independently associated with mental health problems, OR 2.11. Overall, gestational age was not significantly associated with mental health problems, although children with gestational age below 31 weeks were associated with higher risk of mental health problems compared to children born after the 36th week. Several features or correlates of social and economic disadvantage predicted mental health problems in the multivariate model: young maternal age, low household income at the time of birth and the child living without any biological parents or with a single parent in the first year of life.

Table 5 about here

Discussion

In this 5-7 years follow-up of the birth cohort CCC 2000, we found a 4.8% 6-month prevalence of mental health problems assessed by parent and preschool teacher SDQs. The participation rate was 59% and analyses of attrition showed that some psycho-social risk factors were more frequent in non-participants. However, estimates of prevalence, weighted according to differential non-response only increased the prevalence from 4.8% to 5.0%. The prevalence estimates in the present study correspond closely to the 5% prevalence reported by a Danish study of parent SDQ scores in 4,971 children at 7 years of age though this study did not include teacher reports or questions about impact [22]. Conduct problems were the most common mental health problem, found in 3%. Problems of hyperactivity and inattention were found in 0.7 %, with nearly half of these children also having conduct or emotional problems.

The results from the present Danish study correspond to findings in studies from other Nordic countries, both with regard to the SDQ total difficulties mean scores reported by parents and with regard to the specific symptom scores [13;15;16], whereas SDQ studies from other countries in Europe have found higher estimates of prevalence, ranging from 6.3%-9.8%. [18;23-25].

A study of 5855 children aged 5-10 years from Great Britain [18] thus showed a total difficulties score of 9.6 % (teacher reports) and 9.9 % (parent reports), contrasting with the lower rate found in the present study of 5.9 % (preschool teachers reports) and 3.6 % (parents reports). Similarly, the frequency of abnormal symptom scores was lower in all areas in Danish children when compared to British children. In particular with regard to hyperactivity/inattention, where the proportion of Danish children with abnormal symptom scores was 5.6 % (parent reports) and 9.0 % (preschool teacher reports), whereas the corresponding figures in British children were 16 % (parents reports) and 13.8 % (teachers reports).

In a cross-cultural comparison of findings from prevalence studies from Norway and Great Britain, it was shown that a lower prevalence of emotional problems in Norwegian children compared to British children could be explained by Norwegian parents under-reporting emotional symptoms, whereas a lower prevalence of conduct problems and hyperactivity/inattention in Norwegian children was considered to reflect a real advantages in child mental health in Nordic countries [13].

As compared with children in many previously studies, the present CCC2000 sample were younger and had more equal access to social and educational facilities. This could partly explain a lower prevalence [3;13;15]. It is noteworthy that we found an even lower rates of conduct problems and hyperactivity/ inattention problems than the study of Norwegian children. It is also striking that our rate of hyperactivity/inattention problems was so much lower than the 6.4% prevalence of ADHD reported by a study of Danish children at age 8-10 years [26]. Our low prevalence rates should be interpreted in the context of the study. The mean age of the CCC 2000 children in the present study was 5.4 years, and only 4.3% of the children had started school at the time of the SDQ investigation. Instead, they spent their day-time in kindergarten, mostly engaged in free play and outdoors activities – a setting that is much freer from discipline and rules than school. By contrast, children in the majority of European countries start school or school-like day-care before the age of 5 years, and the study from Norway SDQ investigated children at age 8-10 years in school settings. Thus if mental health problems are precipitated or aggravated by the external pressures and demands of school, this could contribute to our lower prevalence. In addition, hyperactivity/inattention symptoms may be under-detected in a

kindergarten setting since pre-school teachers have less opportunity than school teachers to observe children engaged in tasks that require detailed knowledge and concentration.

In the CCC2000 study we found low agreement between parents and teachers reports, with low Kappas for all scales of mental health problems. In addition, there were significant differences in the means SDQ scores from parents and preschool teachers for all SDQ scores other than the peer problem score. Pre-school teachers were reporting more problems than parents in all areas of mental health other than emotional problems and peer problems. Particularly given the low agreement between parents and pre-school teachers found in the present study, the rate of problems may have been underestimated in the quarter of the study population with just one informant.

In conclusion, the relatively low prevalence in Danish pre-school children might thus be substantive and reflect a population at relatively low risk load and at an age characterised by a low exposure to environmental stress and , possibly also reflect methodological shortcomings (underdetection).

Factors associated with mental health problems at age 5-7 years

Male gender was associated with an overall risk of mental health problems and with a higher risk of conduct problems and hyperactivity/inattention which is in accordance with findings in studies of children at other ages and from other cultures [14;16]. Socioeconomic risk factors for mental health problems at child age 5-7 years included young maternal age, low household income, and the child living with a single parent or without any biological parents at the time of birth. Previous studies have found socioeconomic risk factors associated with in particular emotional and conduct disorders [16]. In the CCC2000 study where the majority (94%) of child mental health problems were emotional or conduct problems, we found socioeconomic risk factors being the only significant predictors.

Corresponding associations have been reported in studies of Norwegian and the British children, although only male gender and family type associated with higher risk of conduct problems in the Norwegian study, whereas overall mental health problems were associated with markers of poverty [13;15;16].

Even though this describes predictors and not causal mechanism, it is still a useful reminder of the need for mental health services to focus on children in families with well known socioeconomic risks[27].

Limitations

The main limitation of the study concerns the relatively low rate of participation (59%), particularly among disadvantaged groups where children might plausibly have been more prone to develop mental health problems. This

bias may have resulted in underestimation of the prevalence of mental health problems. However, use of data from National registers made it possible to calculate the weighted prevalence adjusting for non-response, and this did not result in any substantial changes in prevalence.

Another limitation concern the possible informant bias as 26% of the children had missing information from one informant, as has been discussed above.

Finally, the Danish version of SDQ has been forward- and backward-translated as recommended by The World Health Organization [28] but the SDQ has not yet been validated on Danish populations. However, measures of validity and reliability have been established in other European countries – validation studies from Norway and Sweden in particular are relevant since Denmark is quite similar to other Nordic countries in language and culture [15].

Conclusions

In a general population study of children with mean age 5.4 years from the Copenhagen Child Cohort 2000, mental health problems measured by the Strengths and Difficulties Questionnaire were found in 5% with conduct problems being the most common.

Male gender and several socio-economic risk factors measured from birth to child age 4 were associated with higher risk of mental health problems in children age of 5-7 years.

The result from the study replicate findings from other general population studies regarding the possible advantage of mental health in Nordic countries when focusing on conduct and hyperactivity/inattention problems.

The relatively low SDQ problems scores found in the present study might reflect the low-stress context provided by Danish kindergartens, or the greater difficulty of detecting significant hyperactivity and inattention in such a setting. Further planned follow ups of this cohort will demonstrate whether the transition to formal schooling results in a substantial increase in overt mental health problems, particularly hyperactivity-inattention. .

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Conflicts of interests

None

Robert Goodman is director and part owner of Youth in Mind, which provides no-cost software and websites related to the SDQ.

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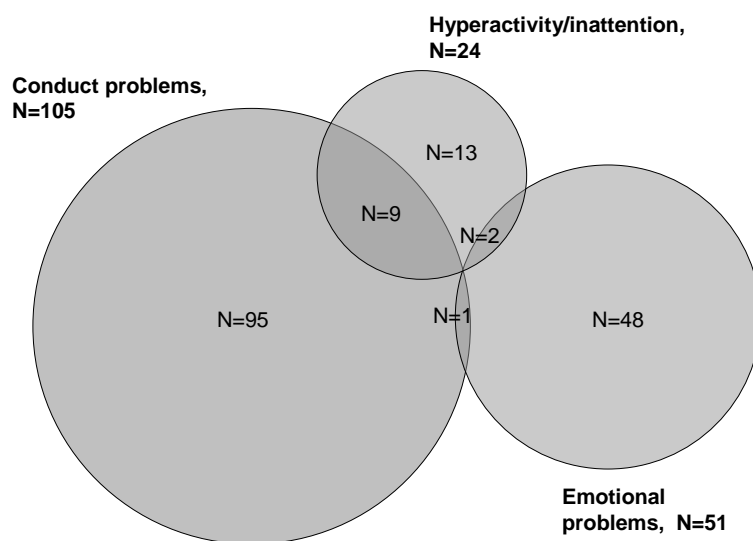**Figure1** Comorbidity in children with abnormal SDQ subscores; N=168

Table 1 Characteristics of the entire birth cohort CCC2000 at the 5-7 years follow-up and attrition analyses based on register data on socioeconomic and perinatal variables

Socioeconomic and perinatal variables	Entire cohort N=6,072 N (%)	Responders N=3,501 N (%)	Non- responders N=2,571 N (%)	P-value** Number and missing
Gender: Boys	3,116 (51.3 %)	1,775 (50.7 %)	1,341 (52.2 %)	0.261; Missing=0
Birth weight, gram: <1500	42 (0.7 %)	23 (0.7 %)	19 (0.8 %)	
1500-2499	236 (4.0 %)	118 (3.5 %)	118 (4.7 %)	
2500-4499	5,497 (92.3 %)	3,158 (92.3 %)	2,339 (92.4 %)	0.001
>4500	178 (3.0 %)	123 (3.6 %)	55 (2.2 %)	Missing 119
Gestational age: 0-31 weeks	45 (0.8 %)	28 (0.8 %)	17 (0.7 %)	
32-36 weeks	334 (5.6 %)	173 (5.0 %)	161 (6.3 %)	0.078
37+ weeks	5,630 (93.7)	5,257 (94.2 %)	2,373 (93.0 %)	Missing =63
Apgar Score, score 0-10				
0-3	6 (0.1 %)	5 (0.2 %)	1 (0.04 %)	0.2371
4-6	31 (0.5 %)	15 (0.4 %)	16 (0.6 %)	Missing=102
7-10	5,933 (99.4 %)	3,412 (99.4 %)	2,521 (99.3 %)	
Birth complications: Yes	530 (8.7 %)	308 (8.8 %)	222 (8.6 %)	0.8243; Missing= 0
Serious malformation: Yes	174 (2.9 %)	106 (3.0 %)	68 (2.6 %)	0.3752; Missing =0
Register-based Psychiatric diagnosis, before the age of five: Yes	102 (1.7 %)	52 (1.5 %)	50 (1.9 %)	0.1709
No	5,970 (98.3 %)	3,449 (98.5 %)	2,521 (98.1 %)	Missing=0
Immigrant status				
2 parents born in Denmark	4,278 (72.3 %)	2,598 (75.8 %)	1,680 (67.5 %)	<0.0001
1 parent born in Denmark	692 (11.7 %)	391 (11.4 %)	301 (12.1 %)	Missing= 158
0 parent born in Denmark	944 (16.0 %)	437 (12.8 %)	507 (20.4 %)	
Maternal age at child birth				
16-20 years	225 (3.7 %)	93 (2.7 %)	132 (5.1 %)	<0.0001
21-30 years	3,124 (51.6 %)	1,744 (50.0 %)	1,380 (53.8 %)	Missing=17
31-40 years	2,622 (43.3 %)	1,595 (45.7 %)	1,027 (40.0 %)	
41-46 years	84 (1.4 %)	57 (1.6 %)	27 (1.1 %)	
Parents living together at child birth: Yes	5,558 (91.8 %)	3,242 (92.9 %)	2,316 (90.3 %)	<0.0002 Missing=17
Maternal education (ISCED*) at child birth				
1-10 years	1,351 (23.8 %)	650 (19.6%)	701 (29.6 %)	<0.0001
11-14 years	2,940 (51.7%)	1,705 (51.4%)	1,235 (52.1 %)	Missing=388
15+ years	1,393 (24.5 %)	960 (29.0%)	433 (18.3 %)	
Family constitution at child birth:				
1) living with both parents	5,041 (83.3 %)	2,993 (85.6%)	2,048 (80.2 %)	<0.0001
2) Living with one parent	670 (11.1 %)	330 (9.4%)	340 (13.3 %)	Missing=20
3) Living in a reconstituted family	327 (5.4 %)	169 (4.8%)	158 (6.2 %)	
4)Living without any parents	14 (0.2 %)	6 (0.2%)	8 (0.3 %)	
Changes in family composition in the first 5 years of life: Yes:	944 (15.6 %)	484 (13.8 %)	460 (18 %)	<0.0001 Missing=16
Household income at child birth:				
1. Quartile (lowest)	1,497	711 (20.4 %)	786 (31.3 %)	<0.0001
2. Quartile	1,497	861 (24.8 %)	636 (25.3 %)	Missing= 83
3. Quartile	1,497	925 (26.6 %)	572 (22.8 %)	
4. Quartile (highest)	1,498	981 (28.2 %)	517 (20.6 %)	

*ISCED= The International Standard Classification of Education (ISCED) designed by UNESCO

** Likelihood Ratio Chi-square test probability for comparison of responders and non-responders

Mental health problems	Boys N=1,775	Girls N=1,726	All N=3,501	Risk Ratio	P-Value*			
SDQ scores	Abnormal %	Borderline %	Normal % (95%CI)	Missings N	P-value* (95% CI)	Mean score (SD)	P-value**	Kappa value*** (95%CI)
Any diagnosis	6.4 (N=114)	3.1 (N=54)	4.8 (4.1-5.6) (N=168)		2.0 (1.5-2.8)	<0.0001		
Total difficulties score / Emotional problems	1.8 P:3.6 (N=31)	1.2 P:4.4 (N=20)	1.5 (1.1-1.9) (N=51) T:8.4	P= 7 T= 22	1.5 (0.9-2.6)	0.14 P:5.9 (4.6) T: 5.3 (5.3)	<0.001	0.27 (0.19-0.34)
Conduct problems	4.2 P:5.9 (N=75)	1.7 (N=30)	3.0 (2.4-3.6) (N=105)		2.4 (1.6-3.7)	<0.0001		
Emotional symptom score / Hyperactivity inattention	1.0 P:7.4 (N=18)	0.4 P:6.3 (N=6)	0.7 (0.4-1.0) (N=24) T:86.3	P= 5 T= 21	2.9 (1.2-7.3)	0.001 P:1.6 (1.8) T:1.3 (1.8)	<0.001	0.19 (0.13-0.26)
Missing	1.1% (N=20)	1.1% (N=19)	1.1% (N=39)					
Conduct	P:6.5	P:8.5	P:85.1	P= 5	<0.001	P:1.2 (1.3)	<0.001	0.22

The SDQ algorithm can generate more than one prediction of mental health problems and therefore the child can be placed in more than one category.

Table 2 6-month point prevalence rates of mental health problems predicted by the Strengths and Difficulties Questionnaire
including all reports from parents and/or pre-school teachers (n=3,501)

* Likelihood Ratio Chi-Square test Probability for comparison of boys and girls

								(0.16-28.7)
problem score	T:8.1	T:5.6	T:86.3	T= 20		T:0.9 (1.5)		
Hyperactivity score	P:5.6	P:3.3	P:91.1	P= 6	<0.001	P:2.4 (2.1)	<0.001	0.29 (0.23-0.36)
	T:9.0	T:3.5	T:87.5	T= 20		T:2.2 (2.6)		
Peer problem score	P:6.4	P:5.1	P:88.5	P= 6	<0.001	P:0.8 (1.4)	0.3124	0.30 (0.22-0.38)
	T:4.3	T:2.7	T:92.9	T= 20		T:0.8 (1.5)		
Prosocial score	P:1.9	P:3.9	P:94.3	P= 4	<0.001	P:8.3 (1.6)	<0.001	0.09 (0.04-0.14)
	T:9.0	T:8.1	T:82.9	T= 21		T:7.8 (2.2)		
Impact score	P:4.8	P:3.3	P:91.9	P= 45	<0.001	P:0.2 (0.9)	0.003	
	T:6.2	T:7.1	T:86.7	T= 72		T:0.2 (0.7)		

Table 3 Comparison of parent and pre-school teacher rated SDQ symptom scores (N=2,442)

P: parent SDQ
T: pre-school teacher SDQ

*   Statistics: Test of Marginal Homogenity for SDQ symptoms scores by parent and pre-school teachers
** Statistics: Wilcoxons signed rank test for difference in means scored by parents and pre-school teachers
***The agreement of parents and pre-chool teachers as indicated by Kappa values

Table 5 Multivariate associations of mental health problems with perinatal and socioeconomic variables. Mental health problems is predicted to be probable or not present

	Multivariate analyses		
Perinatal and socioeconomic variables	cases/N	OR (95% CI)	P-value****
Gender*: Boys	113/1748	2.11 (1.52-2.95)	
Girls	54/1702	ref	<0.0001
Maternal age at child birth**			
16-20 years	12/92	2.65 (1.39 -5.06)	
21-30 years	92/1722	ref	
31-40 years	61/1579	0.71 (0.51-0.99)	
41-46 years	2/57	0.67 (0.16-2.79)	0.001
Maternal education (ISCED) at child birth***			
1-10 years	44/633	1.20 (0.80-1.80)	
10-14 years	84/1686	ref	
15+ years	30/951	0.66 (0.43-1.01)	0.0589
Household income, at child birth***			
1. Quartile (highest)	20/975	0.46 (0.26-0.80)	
2. Quartile	41/914	ref	
3. Quartile	50/845	1.33 (0.87 -2.04)	
4. Quartile (lowest)	54/694	1.63 (1.05-2.54)	0.001

Structure of the Family constitution at child birth***			
1) living with both parents	122/2948	ref	
2) Living in reconstituted family	10/168	1.36 (0.69-2.65)	
3) Living with one parent	32/325	2.21 (1.45-3.38)	
4) Living without any parents	2/6	12.83(2.13-77.18)	0.0001
Gestational Age***			
<31 weeks	4/28	3.154 (1.06-9.39)	
32-36 weeks	7/169	0.86 (0.40-1.87)	
37-43 weeks	155/3222	ref	0.1078

* Adjusted for maternal age

**Adjusted for gender

***Adjusted for maternal age and gender

****Wald chi-Square, type 3 analysis of effects of the explanatory variable in the logistic regression.

Table 4 Univariate associations of mental health problems with perinatal and socioeconomic variables (N=3501)

Perinatal and socioeconomic variables	**Unlikely** N=2770 (79.1%) % (N)	**Possible** N=513 (14.7%) % (N)	**Probable** N=168 (4.8%) % (N)	P-value**	Missing N
Sex: Boys	76.4 % (1340)	17.2 % (301)	6.5 % (114)	<0.0001	39
Girls	84.4 % (1441)	12.4 % (212)	3.2 % (54)		
Register-based Psychiatric diagnosis before the age of five: Yes	46.8 % (22)	19.2 % (9)	34.0 % (16)	< 0.0001	39
No	80.8 % (2759)	14.8 % (504)	4.5% (152)		
Immigrant status:					
2 parents born in Denmark	81.5 % (2104)	13.8 % (356)	4.8 % (123)	0.0029	114
1 parent born in Denmark	81.2 % (310)	14.7 % (56)	4.2 % (16)		
0 parent born in Denmark	73.0 % (308)	20.6 % (87)	6.4 % (27)		
Maternal age at child birth:					
16-20 years	69.6 % (64)	17.4 % (16)	13.0 % (12)	0.03 (Fisher test: 0.01)	51
21-40 years	80.6 % (2659)	14.8 % (489)	4.6 % (153)		
41-46 years	82.5 % (47)	14.0 % (8)	3.5 % (2)		
Maternal education (ISCED*) at child birth:					
1-10 years	72.8 % (462)	20.3 % (129)	6.9 % (44)	< 0.0001	221
11-14 years	81.2 % (1372)	13.7 % (232)	5.0 % (85)		
15+ years	84.8 % (811)	12.3 % (115)	3.1 % (30)		
Household income at child birth:					
1. Quartile (lowest)	72.7 % (506)	19.4 % (135)	7.9 % (55)	<0.0001	62
2. Quartile	78.9 % (671)	15.2 % (129)	5.9 % (50)		
3. Quartile	81.8 % (748)	13.8 % (126)	4.5 % (41)		
4. Quartile (highest)	85.7 % (838)	12.3 % (120)	2.0 % (20)		
Structure of the Family constitution at child birth:					
1) living with both parents	81.2 % (2404)	14.6 % (432)	4.2 % (123)	<0.0001	42
2) Living with one parent	81.0 % (136)	13.1 % (22)	6.0 % (10)		
3) Living in reconstituted family	72.1 % (235)	18.1 % (59)	10.0 % (32)		
4) Living without any parents	66.7 % (4)	0 % (0)	33.3 % (2)		

Changes in family composition in the first 5 year of life:					
0 time (never)	81.52 % (2431)	14.5 % (431)	4.1 % (121)	<0.0001	39
1 time	73.5 % (291)	16.9 % (67)	9.6 % (38)		
2 times	73.1 % (49)	16.4 % (11)	10.5 % (7)		
3 times	62.5 % (10)	25.0 % (4)	12.5 % (2)		

*ISCED= 'Internatioanl Standard Classification of Education' designed by UNESCO

** Likelihood Ratio Chi-Square test probability for comparison of mental health problems predicted to be unlikely, possible and probable