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Title:

Does paternal mental health in pregnancy predict physically aggressive behavior in children?

Short title:

Fathers' distress and child aggression

Abstract

Aim To study the association between paternal mental health and physically aggressive behavior in children.

Methods This study is based on 19,580 father-child dyads from the Norwegian Mother and Child Cohort Study (MoBa). Fathers' mental health was assessed by self-report (Symptom Checklist-5, SCL-5) in week 17 or 18 of gestation. Children's behavior (hitting others) was obtained by mothers' reports. A multinomial logistic regression model was performed.

Results Expectant fathers' high level of psychological distress was found to be a significant risk factor only for girls hitting, adjusted OR=1.46 (1.01-2.12), p=0.043, but not for boys.

Conclusion High levels of mental distress in fathers predict their daughters' hitting at five years of age.

Keywords Paternal, pregnancy, children, aggression

Abbreviations

ASQ - Ages and Stages Questionnaire

CBCL-R - Child Behavioral Checklist Revised

MoBa - Mother and Child Cohort Study

MSS - Marital Satisfaction Scale

SCL-5 - Symptom Checklist-5

Introduction

Knowledge about the developmental trajectory of physically aggressive behavior in pre-school aged children is limited (Tremblay et al., 2004). Longitudinal studies indicate that physically aggressive behavior in children is common in the first year of life and then, for most children, declines in the pre-school years (Alink et al., 2006; Tremblay et al., 2004). However, for a small group of children, physically aggressive behavior persists into adolescence (Cote, Vaillancourt, LeBlanc, Nafin, & Tremblay, 2006; Tremblay et al., 2004). Children who show high levels of physically aggressive behavior during early childhood are more at risk for externalizing and internalizing problems and for developing psychiatric disorders later in life (Campbell, Spieker, Burchinal, & Poe, 2006). Studies have also found sex differences in physically aggressive behavior in children that emerge in preschool years. These studies indicate that boys show more physically aggressive behavior than girls (Alink et al., 2006; Cote et al., 2006; Temblay R. E. et al., 1999; Tremblay et al., 2004). The frequency of physically aggressive behavior in pre-school aged children is also higher in families with more than one child (Tremblay et al., 2004).

Earlier studies have looked at the frequency and trajectories of physically aggressive behavior in young children. In a population based study (N=572), Tremblay et al. (2004) identified three trajectories of physically aggressive behavior based on the frequency of behavior such as biting, hitting, kicking, bullying and fighting in children at 17, 30 and 42 months of age (Tremblay et al., 2004). The largest group followed a developmental trajectory of modestly aggressive behavior (58%).The second largest group was composed of children who displayed little or no physical aggression at all observation points (28%) and the third and smallest group followed a trajectory of increasingly high physical aggression (14%). Another longitudinal study (N=271) found that physically aggressive behavior occurred in 12-month-olds, increased significantly in 24- and 36-month-olds (Alink et al., 2006), and then declined

after the third year of life. Based on these findings, physically aggressive behavior such as hitting in infancy may be seen as a common way of expressing anger, but most children learn to regulate this behavior during their preschool years. However, those children who show less capacity to regulate aggressive behaviors are at risk for mental health problems and antisocial behavior later in life (Alink et al., 2006). Among most children at three years of age, hitting is still a frequently occurring behavior. However, at age five most children should have learned to control their physically aggressive behavior and how to use other conflict resolution strategies. Persistent hitting behavior after five years of age predicts externalizing and internalizing problems and developing psychiatric disorders later in life (Cote et al., 2006).

A more thorough understanding of early predictors of behavior problems in children is necessary, specifically factors that could predict the risk of recurring physical aggression in children. Some studies suggest that physically aggressive behavior is influenced by both genetic and environmental factors (Dionne, Tremblay, Boivin, Laplante, & Perusse, 2003). Studies that focused on genetic influences found that half of the variation in aggressive behavior, behavioral disorders, and crime can be attributed to genetics (Rhee & Waldman, 2002). Environmental factors, such as coming from a low-income family or having parents who have serious problems living together, increase the risk of high trajectories of physical aggression in children (Tremblay et al., 2004). Parental mental health has also been found to be associated with developmental difficulties and problem behavior in children (Goodman & Gotlib, 1999; Hollins, 2007; Ramchandani et al., 2008). Other studies have found an association between expectant fathers' mental distress and behavioral, emotional, and social functioning in their three-year- old children (Kvalevaag et al., 2013; Ramchandani et al., 2008). Furthermore, disengaged interaction between fathers and their children at three months of age predicted behavior problems when the children reached one year of age (Ramchandani

et al., 2013). However, there is a lack of studies investigating the risk that expectant fathers' mental health represents for the development of physically aggressive behavior in their children. Designing effective interventions to prevent persistent physically aggressive behavior in childhood, will require more knowledge about children who display signs of physically aggressive behavior and are also at risk for developmental and social problems.

This study aims first to investigate the risk that psychological distress in expectant fathers represents for children hitting others at five years of age. Second, to assess the prevalence of physically aggressive behavior (defined as hitting others) in a large preschool aged population of children, at 18 months, 3 and 5 years of age, and to explore whether there are gender differences in the prevalence of hitting among children.

Method

Participants

This study is based on data from the Norwegian Mother and Child Cohort Study (MoBa) conducted by the Norwegian Institute of Public Health. MoBa is a prospective population-based pregnancy cohort study. Participants were recruited from across Norway from 1999-2008, and 39% of the women who were invited consented to participate (Magnus et al., 2006). The cohort now includes (as of October 2012) 109,000 children, 91,000 mothers, and 71,700 fathers.

The current study is based on version V, April 2010, of the quality-assured data files released for research. Informed consent was obtained from each MoBa participant upon recruitment. This study was approved by the Regional Committee for Medical Research Ethics, Health Region South-Eastern Norway, 18. th of February, 2011.

To be included,eash family was required to provide the following information: the mothers' questionnaire at 17 or 18 weeks of gestation, the fathers' questionnaire at 17 or 18 weeks of gestation, and the mothers' report concerning the children at 18 months, 3 years and 5 years of age. There were a total of 20,155 completed questionnaires for these points of measurement, which translates to N=19,580 father-child dyads.

Measures

Predictor variables

Symptom Checklist -5 (SCL-5)

The SCL-5 is an indicator of global mental distress that has been used as a screening measure of psychological distress in several studies (Eriksen, Tambs, & Knardahl, 2006; Holm, Tyssen, Stordal, & Haver, 2010; Strand, Dalgard, Tambs, & Rognerud, 2003; Tambs et al., 2009). The SCL-5 has five items: (1) Feeling fearful, (2) Nervousness or shakiness inside, (3) Feeling hopeless about the future, (4) Feeling blue and (5) Worrying too much about things. Each of the five items is scored on a scale of 1 to 4, depending on how bothered the participants have been in that area in the 14 days prior to the time of self-report: 1=not bothered, 2=a little bothered, 3=quite bothered, and 4=very bothered. The checklist mainly screens for symptoms of anxiety and depression (Tambs & Moum, 1993). SCL-5 correlates highly with SCL-25 (Person's correlation=0.92). The recommended cut-off on the SCL-5 total mean score, indicating distress at case-level, is 2.00.

Of the N=20,155 fathers in the total sample, n=153 (1%) had missing information on one or more items of the SCL-5. Fathers with missing items were excluded from the analysis leaving N=20,002 fathers with valid SCL-5 scores. The fathers' mean score was (M)=1.12, with a

standard deviation (SD)=0.28, range; min=1 max=4. The SCL-5 score was dichotomized at the recommended raw score of 2.00, and a score > 2.00 indicates "case-ness" (Strand et al., 2003).

Of the 20,155 mothers in the total sample, seven (0.03 %) had missing information on the SCL-5. The mothers' mean score was M=1.27, with standard devition SD=0.33, range; min=1, max=4.

Outcome variables

Child Behavioral Checklist Revised (CBCL - R)

The CBCL is a standardized adult-report instrument used to assess a broad array of manifestations of internalized and externalized psychopathology in children from one and a half to five years of age (Achenbach & Ruffle, 2000; Nøvik, 1999). The instrument contains 100 items rated on a three-point scale: 0=not true, 1=somewhat or sometimes true, 2=very true/often true. One of the items from this scale, "Hits others", is used as an outcome variable in the analysis below. The frequency of children's hitting at 18 months, 3 years and 5 years of age are presented for the total sample as well as for boys and girls separately in Table 2.

- Please insert Table 2 here -

The variable was dichotomized with children hitting others reported as "sometimes true" and "often true" in one category and "not true" in the other. Children with missing information on this item (N=326) were excluded from the analysis. Thus, in the present analysis, the valid sample includes 19,580 father-child dyads. The dichotomized variables representing hitting at

18 months, 3 years and 5 years of age were then operationalized into one outcome variable with three different levels: Never hits (reference category), n=7,533 (39%), stopped hitting before five years of age, n=8,911 (46%), and hitting at five years of age (all children hitting at five years of age), n=3,136 (16%).

Covariates included in the analyses

The following socio-demographic characteristics as reported by fathers at week 17 or 18 of gestation were included in the analyses: fathers' age, level of education, marital status, self-reported somatic health problems (including diabetes, cancer, cardiovascular disease, epilepsy, neck /shoulder/ lower back pain, high blood pressure, ankylosing spondylitis /rheumatoid arthritis) and other long-term physical illness (yes/no), and lifestyle variables such as cigarette smoking (yes/no) and use of alcohol (never/seldom, 1-4 times /month, 2-7 times/week) (Table 1).

Mothers' mental health was measured by the Symptom Checklist-5 (SCL-5) and fathers' relationship satisfaction was measured by the Marital Satisfaction Scale (MMS). Children's language skills at 3 and 5 years were measured by two items from the Ages and Stages Questionnaire (ASQ). In addition, the mothers reported on siblings in the family and if they were living with the father.

Marital Satisfaction Scale (MSS)

The MoBa questionnaire contained five items from MSS (Blum & Mehrabian, 1999): (1) My partner and I have problems in our relationship; (2) I am very happy in my relationship; (3) My partner is usually understanding; (4) I am satisfied with my relationship to my partner;

and (5) We agree about how children should be raised. Each of the items were scored on a six point scale; 6=totally agree, 5=agree, 4=slightly agree, 3=slightly disagree, 2=disagree, 1=totally disagree. The negatively worded item (n=1) was inverse-scaled and a summary scale was computed by adding up item scores. Higher scores on the summary scale indicated a more positive relationship with the spouse. Internal scale consistency as assessed by Cronbach's alpha for fathers' MSS was 0.71, M=26.34, SD=3.17 and range=25.

Children's language skills

We have also included two items form the Ages and Stages Questionnaire (ASQ) as covariates because others have found that children's language skills at five years of age are a significant predictor of physical aggressive behavior (Alink et al., 2006).

The Ages and Stages Questionnaire (ASQ) is a screening instrument for child development from 4 to 60 months of age based on parents' report (Squires, Bricker, & Potter, 1997). It contains 30 items, with each item scored on a three point scale: 1=yes, 2= few times, 3=not yet. Two items were used in the present analyses:

- "Without giving him/her help by pointing or using gestures, ask your child to "Put the shoe on the table" and "Put the book under the chair". Does your child carry out both of these directions correctly? (impressive language skill) .
- "Can your child tell you at least two things about an object he/she is familiar with? If you say, for example, "Tell me about your ball", will your child answer by saying something like "It is round, I can throw it, it is big"? (expressive language skill).

Descriptive statistics of children's language skills at five years of age are shown in Table 2.

Siblings in the family

One Question included as adjustment variable, asked how many siblings there were in the family when the child was five years of age: No siblings in the family; N=17,977 (89%); one sibling N=314 (2%); two children N=1,043 (5%); three children N=613 (3%); four or more children N=208 (1%).

Living with father

We also included one question asking if the mother was living with the father when the child was five years of age: yes, n=18,278; no, n=1,579; if the mother has never lived with the father, n=226; and missing information, n=72.

Statistical analyses

To explore the predictive value of fathers' psychological distress during their partner's pregnancy for future hitting behavior in their children we used a multinomial logistic regression model with fathers' SCL-5 dichotomized at cut-off 2.00 as the predictor variable and children's hitting at 18 months, 3 years and 5 years of age operationalized as an outcome variable with three different levels (never hit others, stopped hitting before five years, and hitting at five years of age). All analyses were adjusted for fathers' age, education, somatic health, marital status, and lifestyle variables such as cigarette smoking and use of alcohol, as well as mothers' psychological distress (SCL-5), fathers' marital satisfaction (MSS), children's language skills at five years of age (ASQ), siblings present in the family, and whether the child was living with the father(separate adjustments), as these variables could confound the relationship studied. Tests were two-tailed with the significance level set at $p<0.05$. All analyses were conducted using SPSS PASW 18.0 for Windows.

Results

Socio-demographic and clinical characteristics of fathers in the total sample (N=20,155) are presented in Table 1.

- Please insert Table 1 here -

At 5 years of age around 16% of the children in this population based sample still showed physically aggressive behavior. The boys in this sample hit others significantly more often as compared with the girls at both 18 months and 3 years of age, but not at 5 years of age (Table 2 and Figure1).

- Please insert Table 2 here -
- Please insert Figure 1 here -

In the multinomial logistic regression model with fathers' SCL-5 as predictor and the outcome variable with three categories representing children's hitting, we found a significantly higher crude risk of children hitting at 5 years of age when expectant fathers reported high level of psychological distress; odds ratio (OR)=1.34, 95% confidence interval (CI)=1.05-1.72, *p*=0.019. After adjustment for the covariates this increased risk was no longer significant; fully adjusted OR=1.24, CI=0.96-1.60, *p*=0.100 (Table 3). However, when the sample was stratified for gender there was a significant higher risk of girls hitting at five years of age when the fathers reported high level of psychological distress, adjusted OR=1.46 (95% CI=1.01-2.12), *p*=0.043; but not for boys, adjusted OR=0.1.03 (95% CI=0.72-1.47), *p*=0.860.

In the separate adjustments, the covariates representing children's language function lead to a large increase in OR for hitting others. The OR for hitting others at five years in the total sample was OR=1.78 (95% CI=1.53-2.08), *p*=0.000 and OR=1.87 (95% CI=1.68-2.09), *p* =0.000, respectively, when adjusted for expressive and impressive language function. Adjustment for fathers' MSS lead to an attenuation of risk for hitting at age five, adjusted OR=0.98 (95% CI=0.96-0.99), *p*=0.001. Also, when controlling for the variable of living with the father, the OR decreased, adjusted OR=0.80 (95% CI=0.71-0.90), *p*=0.000.

- Please insert Table 3 here –

Discussion

In the crude analysis performed for the total sample, a high level of psychological distress in expectant fathers predicted an increased risk of their five-year-old children hitting others, as compared to children who never hit others. However, after adjustment for confounding variables, this increased risk was no longer significant in this population sample. Expectant fathers' high level of psychological distress was found to be a significant risk for hitting at 5 years of age only for the five-year-old girls' in the fully adjusted model. Further, and interestingly, adjustment for children's language skills led to an increased risk for hitting others, suggesting that language function is a suppressor in the relationship between fathers' mental distress and children's hitting behavior five years later.

Fathers' mental health and physical aggression in their children

To our knowledge, the present study is the first to detect a risk associated with high levels of psychological distress in expectant fathers for their preschool-aged children's physically aggressive behavior. The risk attenuated when confounders were controlled for: however, in the fully adjusted model, there was a significant risk for the girls in this sample. Earlier studies have found an association between psychological distress among expectant fathers and later behavioral, emotional, and social difficulties in their children (Kvalevaag et al., 2013; Ramchandani et al., 2008). The association found between fathers' mental health and their children's development may indicate either that the risk is genetically transmitted (Velders et al., 2011), or that the fathers' mental health affects the mothers' distress level in pregnancy, thus possible affecting the fetus (Field, Diego, & Hernandez-Reif, 2006), or that the care of the child after birth is detrimentally affected by the fathers' mental distress (Matthey, Barnett, Ungerer, & Waters, 2000). Other studies found that both fathers' and mothers' prenatal depression is a significant predictor of their postnatal mood (Matthey et al., 2000), that parents' mental health in the postnatal period affects their parenting (Lamb, 2012; Paulson, Dauber, & Leiferman, 2006; Paulson, Keefe, & Leiferman, 2009), and that early father-infant interaction at three months predicts behavioral problems in one-year-old children (Ramchandani et al., 2013). All of these findings point to the importance of focusing on expectant fathers' mental health and the opportunity for preventive interventions in expectant families that exhibit psychological difficulties in pregnancy. In this study, we found that the effect of high level distress in fathers on children's regulation and control of physical aggression was only apparent at five years of age, the stage at which most children have learned to control their aggressive behavior and use other conflict resolution strategies. The finding in the present study, that 16 % of the children use hitting behavior in their interaction with others and that fathers' psychological distress represents a risk for this behavior in their

five-years-old daughters, is an important one, offering new information for the field of early onset behavioral difficulties in childhood.

In the present study, adjustment for fathers' marital satisfaction led to an attenuation of OR to below 1.00 for the risk that expectant fathers' high level psychological distress represented for children at 5 years of age to hit others. This suggests that fathers' marital satisfaction is a strong confounder in the relationship between fathers' mental distress and hitting, which is in accordance with Hanington et al., who also found that antenatal parental depression and marital conflict have a negative impact on child behavioral outcomes. In their study marital conflict acted as an independent risk for adverse outcome and partly mediated the relationship between postnatal depression in both mothers and fathers and child outcome (Hanington, Heron, Stein, & Ramchandani, 2012). The fact that fathers' high marital satisfaction overrode the effect of fathers' mental health on children's hitting in the present study also suggests that marital satisfaction has a strong, and possibly independent effect on children's hitting behavior. Also, in line with these finding are also the finding of Tremblay et al. who showed that parents who have difficulties living together had an increased risk of physically aggressive children (Tremblay et al., 2004). As the relationship between parents and their marital satisfaction is important for parenting and children's wellbeing, future investigations concerning preventive health-care for expectant parents should take these factors into consideration.

Further, the increased OR for hitting, after adjustment for children's language development, suggests that children's language development has a suppressor effect in the relationship between fathers' mental distress and hitting behavior. This means that the predictive power of fathers' mental distress in pregnancy for hitting behavior is actually stronger than what was observed in the crude analysis. The finding that language skills impact hitting behavior is in

line with earlier studies (Alink et al., 2006; Dionne et al., 2003). Dionne et al. stated that there is a high comorbidity between language development and a variety of disruptive behaviors in preschool-aged children (Dionne et al., 2003). They found that language skills and aggression were each influenced by genetic or environmental factors, and environmental factors were found to have a greater impact on language skills.

Prevalence of hitting

The frequency of children who never hit others in the total sample was 65% at 18 months, 62% at 3 years, and 83% at 5 years of age in our study, whereas Tremblay et al. (Tremblay et al., 2004) found that only 28% of children displayed little or no physical aggression from 17 to 42 months of age. One of the limitations in our sample was the moderate participation rate, and Nilsen et al. conclude that the prevalence estimates of exposure and outcomes are biased because of self-selection in MoBa (Nilsen et al., 2009). The MoBa participants have been found to be healthier and to have a somewhat higher level of education than the general Norwegian population (Rosand, Slinning, Eberhard-Gran, Roysamb, & Tambs, 2011); this possibly explains the lower frequency of hitting in our sample as compared to the sample used by Tremblay et al.(Tremblay et al., 2004). Furthermore, in our study, physically aggressive behavior was measured only as children hitting others, whereas in Tremblay's sample physically aggressive behavior included hitting, kicking, biting, bullying, and fighting others. The fact that Tremblay et al. used a broad definition and a higher number of indicators to measure aggressive behavior than our study, may explain the higher prevalence of such behavior in their study. Further, cultural differences may also affect the frequency of physically aggressive behavior in children, which could explain the differences between Tremblay's Canadian and our Norwegian sample. A possible cultural difference was also found in a study that compared questionnaire data from population surveys in Norway and Britain. In this study, the researchers found that the Norwegian questionnaire scores for

externalizing problems in children were lower than the British scores, reflecting substantial differences between the two countries concerning parents' reports on questionnaires about their children's behavior (Heiervang, Goodman, & Goodman, 2008).

Gender issues

Boys in this sample hit others significantly more often compared with girls at both 18 months and 3 years of age, but not at 5 years of age (Figure 1).There were no significant differences in language skills between boys and girls. Furthermore, when the sample was stratified for gender, fathers' mental health was found to be a significant risk only for girls' hitting behavior at 5 years of age. In an earlier study we found that there was a consistent association between fathers' psychological distress in pregnancy and the children's behavioral, emotional, and social functioning at three years of age. However, gender did not affect the association at this age (Kvalevaag et al., 2013). Others have found that boys may be more vulnerable to the effect of paternal depression than girls in early childhood (Ramchandani P.G., Stein, Evans, & O'Connor, 2005). In contrast to these findings, a lack of involved parenting from fathers was found to have an impact particularly on girls as they reached adolescence (Fouri E. & A., 2003). These findings of gender differences in the impact of fathers' mental health on their children's development are divergent, warranting further investigation of possible gender differences.

Strengths and limitations of this study

One of the major strengths of this study is that it is population-based with a large sample size and as such has statistical power to detect even small effects. By testing the association

between fathers' mental health and their children's development in a large population sample, the serious selection biases that are commonly found in clinical studies have largely been avoided. The prospective design of the study makes a child-to-parent effect less likely to be the cause of the effect found. Rather, the associations we found represent evidence for parent-to-child directionality.

A weakness of this study is the modest participation rate, which was 39%. Low participation rates may lead to selection biases because study participants may differ from non-participants in ways that are not random with respect to exposure (Nohr, Frydenberg, Henriksen, & Olsen, 2006). In the Tromsø Health Study (Hansen, Jacobsen, & Arnesen, 2001), the attendance rates were 20% lower for men and women with psychiatric illness; the authors concluded that in health population studies, this inclusion bias might lead to an underestimation of the prevalence of psychiatric conditions in the population. Nilsen et al. conducted a study in which they compared data from the MoBa with information from the Medical Birth Registry for Norway (all women giving birth in Norway) and concluded that the prevalence estimates of exposure and outcome, but not the exposure-outcome associations, are biased due to self-selection in the MoBa (Nilsen et al., 2009). Non-participation may thus affect the general applicability of the findings, but not the validity of the associations found.
Moreover, the measures of the predictor variables were self-reported and the outcome variables of children's development were based on mothers' reports, which constitute additional weaknesses in this study. The use of self-report scales may be affected by rater bias. However, the predictor variable was the fathers' report and the report on the outcome variable was the mothers' report. Additionally, previous studies have shown that parental reports on their children are highly reflective of "genuine" problems (Filipek PA, 2000; Glascoe FP, 1997). Though Tremblay defines physically aggressive behavior as " behavior that can cause harm to people, animals, or objects" (Tremblay, 2000) and states that the

criterion of intent is not necessary in the definition of physically aggressive behavior in young children, we chose to measure hitting because it is a concrete type of physically aggressive behavior, which makes it relatively easy for the parents to discern and quantify. This increases the reliability of the parents' reports (Alink et al., 2006).

Around 16% of the children in this population based study still used physically aggressive behavior, defined as hitting others, at 5 years of age. High-levels psychological distress in expectant fathers predicted an increased risk of hitting in their children at this age. However, this increased risk of hitting behavior was explained by confounding variables, and when stratified for gender, a significantly increased risk was only found for girls at 5 years of age. Based on these findings, we conclude that there is a need for further studies about the risk factors involved in the development of physically aggressive behavior in childhood and the risk such behavior may represent for children's further development. However, the finding that fathers' mental health during pregnancy represents a risk of later aggression in children suggests that future health planning and research studies should be focused on early detection and prevention.

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Table 1. Sociodemografic characteristics of fathers in the total sample (N=20,155).

Frequencies (N) and percentages (%)

Variable	Category	N (%)
Age	≤19	48 (0.2%)
	20-24	889 (4.4%)
	25-29	5,142 (25.5%)
	30-34	8,151 (40.4%)
	35-39	4,267 (21.2%)
	40-44	1,220 (6.1%)
	45-49	335 (1.7%)
	≥50	103 (0.5%)
Marital status	married	10,650 (52.8%)
	co-habiting	9,079 (45.0%)
	divorced/separated	150 (0.7%)
	widower	49 (0.2%)
	other	227 (1.1%)
Education at baseline	secondary education	804 (4.0%)
	3 years further education	8,961 (44.5%)
	higher education (university/college)≤4 years	5,422 (26.9%)
	higher education (university/college)≥4 years	4,175 (20.7%)
		793 (3.9%)
Cigarette smoking	no	17,014 (84.4%)
	yes	3,141(15.6%)
Use of alcohol	never/seldom	5,463 (27.1%)
	once -3 times/month	11,887 (59.0%)
	1-7 times/ week	2,212 (11.0%)
	missing	593 (2.9%)
Somatic health problems	no	16,278 (80.8%)
	yes	3,877 (19.2%)

Table 2. Descriptive statistics of physically aggressive behavior (hitting others) and language skills (expressive and impressive) in children in the total sample (N=20,155), and for boys and for girls, respectively. Frequency, percentage and *p*-value.

Item/instrument	Time of measurement	Scale	Total sample N (%)	Boys N (%)	Girls N (%)	*p*
Hits others (CBCL)	18 months of age	Not true	12,812 (64.6%)	6,167 (60%)	6,645 (67.3%)	0.000
		Sometimes true	6,875 (34.1%)	3,829 (37.3%)	3,046 (30.8%)	
		Often true	354 (1.8%)	226 (2.2%)	128 (1.3%)	
		missing	114 (0.5%)	57 (0.6%)	57 (0.5%)	
Hits others (CBCL)	3 years of age	Not true	12,501 (62%)	5,650 (55%)	6,851 (69.4%)	0.000
		Sometimes true	7,111 (35.3%)	4,303 (41.9%)	2,808 (28.4%)	
		Often true	323 (1.6%)	217 (2.1%)	106 (1.1%)	
		missing	220 (1.1%)	109 (1.1%)	111 (1.2%)	
Hit others (CBCL)	5 years of age	Not true	16,833 (83.5%)	8,556 (83.2%)	8,277 (83.8%)	0.539
		Sometimes true	3,029 (15%)	1,575 (15.3%)	1,454 (14.7%)	
		Often true	153 (0.8%)	77 (0.7%)	76 (0.8%)	
		missing	140 (0.7%)	71(0.7%)	69 (0.7%)	
Expressive language (ASQ)	5 years of age	Yes	19,177 (95.1%)	9,797 (95.3%)	9,389 (95%)	0.309
		Sometimes	637 (3.2%)	306 (3.0%)	331 (3.4%)	
		Not yet	121 (0.6%)	63 (0.6%)	58 (0.6%)	
		missing	220 (1.1%)	113 (1.1%)	107 (1.1%)	
Impressive language (ASQ)	5 years of age	Yes	17,674 (87.7%)	9,037 (87.9%)	8,637 (87.5%)	0.104
		Sometimes	1,528 (7.6%)	757 (7.4%)	771 (7.8%)	
		Not yet	236 (1.2%)	134 (1.3%)	102 (1%)	
		missing	717 (3.6%)	351 (3.4%)	366(3.7%)	

Table 3. Multi nominal logistic regression model with fathers' SCL-5 (dichotomized at 2. 00) as predictor variable and outcome variable with three levels;
children stopped hitting before five years, children hitting at five years and children never hitting as reference category (N=7,533, 39%).
Odds ratio (OR) and 95% confidence intervals (CI) for OR. Study sample, N=19,580.

	Study sample N=19,580		**Boys** N=9.988		**Girls** N=9,592	
	Stopped hitting before five years of age N=8,911 (46%)	**Hitting at five years of age** N=3,136 (16%)	**Stopped hitting before five years of age** N=5,052 (51%)	**Hitting at five years of age** N=1,630 (16%)	**Stopped hitting before five years of age** N=3,859 (40%)	**Hitting at five years of age** N=1,506 (16%)
	OR (95%CI) ***p***	**OR (95%CI)** ***p***	**OR (95%CI)** ***p***	**OR (95%CI)** ***p***	**OR (95%CI)** ***p***	**OR (95%CI)** ***p***
Crude	1.18 (0.97-1.43) 0.101	1.34 (1.05-1.72) 0.019	1.05 (0.81-1.36) 0.721	1.14 (0.81-1.60) 0.464	1.27 (0.95-1.69) 0.112	1.57 (1.10-2.24) 0.014
Separate adjusted models						
Fathers' age	0.98 (0.96-1.02) 0.270	1.00 (1.00-1.04) 0.834	0.99 (0.95-1.03) 0.553	1.01 (0.95-1.06) 0.853	0.98 (0.94-1.02) 0.410	1.01 (0.95-1.06) 0.847
Fathers education	1.08 (1.42-1.11) 0.000	1.03 (0.99-1.07) 0.211	1.08 (1.03-1.13) 0.001	1.04 (0.98-1.10) 0.225	1.08 (1.03-1.12) 0.001	1.02 (0.96-1.08) 0.502
Marital status	0.99 (0.95-1.03) 0.660	1.01 (0.96-1.07) 0.657	0.98 (0.92-1.04) 0.484	0.98 (0.90-1.06) 0.563	0.99 (0.93-1.05) 0.739	1.05 (0.96-1.14) 0.279
Fathers' use of alcohol	0.97 (0.93-1.01) 0.172	0.1.0 (0.93-1.06) 0.891	1.00 (0.94-1.06) 0.920	1.04 (0.95-1.13) 0.406	0.95 (0.89-1.01) 0.088	0.96 (0.88-1.04) 0.340
Fathers' cigarette smoking	1.07 (0.98-1.16) 0.140	0.96 (0.85-1.08) 0.450	1.06 (0.94-1.19) 0.384	1.02 (0.87-1.20) 0.803	1.08 (0.96-1.22) 0.196	0.89 (0.75-1.05) 0.171
Fathers' somatic condition	1.04 (0.96-1.12) 0.357	1.09 (0.98-1.21) 0.111	1.02 (0.92-1.15) 0.683	1.10 (0.95-1.28) 0.201	1.06 (0.95-1.18) 0.318	1.08 (0.93-1.25) 0.327
Fathers' MSS	0.96 (0.95-0.97) 0.000	0.98 (0.96-0.99) 0.001	0.96 (0.94-0.97) 0.000	0.98 (0.96-1.00) 0.014	0.97 (0.95-0.98) 0.000	0.98 (0.96-1.00) 0.015
Mothers' SCL-5	1.42 (1.24-1.63) 0.000	1.17 (0.96-1.41) 0.115	1.46 (1.20-1.78) 0.000	1.17 (0.90-1.54) 0.247	1.36 (1.12-1.66) 0.002	1.16 (0.88-1.52) 0.293
Child expressive language 5 years	1.00 (0.87-1.16) 0.969	1.78 (1.53-2.08) 0.000	1.09 (0.88-1.35) 0.431	1.87 (1.48-2.36) 0.000	0.95 (0.77-1.16) 0.585	1.74 (1.41-2.16) 0.000
Child impressive language 5 years	1.08 (0.98-1.20) 0.109	1.87 (1.68-2.09) 0.000	0.99 (0.86-1.13) 0.837	1.89 (1.62-2.20) 0.000	1.21 (1.05-1.39) 0.008	1.84 (1.56-2.15) 0.000
Siblings	1.02 (0.98-1.06) 0.383	1.05 (0.99-1.10) 0.087	1.01 (0.96-1.07) 0.753	1.04 (0.97-1.12) 0.254	1.03 (0.97-1.08) 0.346	1.04 (0.98-1.12) 0.211
Living with father	0.92 (0.84-1.01) 0.063	0.80 (0.71-0.90) 0.000	0.89 (0.78-1.01) 0.078	0.82 (0.69-0.97) 0.018	0.95 (0.84-1.09) 0.487	0.78 (0.66-0.92) 0.003
Fully adjusted	0.99 (0.81-1.21) 0.907	1.24 (0.96-1.60) 0.100	0.87 (0.66-1.15) 0.325	1.03 (0.72-1.47) 0.860	1.09 (0.81-1.47) 0.583	1.46 (1.01-2.12) 0.043

Figure 1. Frequencies and confidence intervals (CI) of hitting behavior in children at 18, 36, and 60 months of age.