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Original Article

Trajectories of children evaluated for abuse

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ABSTRACT

INTRODUCTION. Child abuse increases the risk of substance abuse and non-suicidal self-injury, but the topic of school absenteeism and number of offspring has not been studied prospectively. This study presents the first assessment of these four outcomes among children evaluated for exposure to child abuse.

METHODS. In the 2001-2007 period, the Department of Forensic Medicine, Aarhus University, Denmark, evaluated 375 children for exposure to abuse. These children were age- and gender-matched to children from population registries at a 1:6 ratio. Excluding siblings, 2,573 children were analysed. We used the Danish Education Register, the National Patient Register and the Central Civil Register to estimate outcomes and covariates. Negative binomial or Poisson models were used. Follow-up included data until 2016.

RESULTS. For children aged 10-16 years, the incidence rate ratio (IRR) of substance abuse was increased for suspected abuse. The IRR of severe non-suicidal self-injury was 5.03 (95% confidence intervals (CI): 2.59-9.77) for children ≥ 7 years old. School absenteeism had an IRR of 1.30 (95% CI: 1.01-1.68) among children aged 0-3 years. The number of offspring was increased among children aged 12-16 years with suspicion of sexual abuse, IRR = 1.67 (95% CI: 1.27-2.20), and for children aged 8-11 years with suspicion of any abuse, IRR = 3.93 (95% CI: 2.14-7.22).

CONCLUSIONS. Children evaluated for exposure to child abuse differed from their peers on all measured outcomes. The health and social services should devote attention to this group and the families they form.

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TRIAL REGISTRATION. Not relevant.

Child abuse has negative impacts throughout life, increasing the risk of various psychiatric conditions [1, 2], including posttraumatic stress disorder [3] and several other adverse health and life trajectory consequences [4]. For example, child abuse increases the risk of substance abuse [5] and non-suicidal self-injury [6]. This has also been confirmed among Danish children [7]. Child abuse victims may also have increased rates of school absenteeism. A Swedish cross-sectional study found associations between child abuse and absenteeism among 1,520 children [8]. However, we know of no studies with a longitudinal design, complicating a predictive interpretation of the results. Patterns of family formation may also be affected by abuse, including number of offspring. Thus, a study found that childhood physical and sexual abuse was associated with an increased risk of adolescent pregnancy [9]. Differences in frequency and timing of offspring among child abuse victims and their peers may be neither adverse nor favourable. Still, awareness of these differences is relevant for policy development as the offspring of maltreated parents may experience adverse mental consequences [10] and need support services. To the best of our knowledge, the number of offspring among child abuse victims has never

been compared with that of their non-abused peers. Still, based on the first author's clinical experience, the number of offspring may be increased among child abuse victims.

Children evaluated for possible exposure to abuse have been less intensively studied than confirmed or self-reported cases. Still, prior reports to social services increase the risks of subsequent lethal maltreatment, [11] or new reports, [12] regardless of whether social services found sufficient evidence to substantiate the reports or not [11, 12]. To the best of our knowledge, no Danish studies have explored suspected but unsubstantiated exposure to abuse.

This study reports the outcomes of substance abuse, severe non-suicidal self-injury, school absenteeism and the number of offspring following evaluation for child abuse exposure, including the first available analysis of longitudinal data on suspected child abuse and school absenteeism, and the first assessment of the number of offspring among child abuse victims. We hypothesised that increased substance abuse, non-suicidal self-injury, school absenteeism and a heightened number of offspring would be found among children evaluated for exposure to child abuse.

Methods

We used a cohort of 2,606 children, within which 375 children were examined by the Department of Forensic Medicine, Aarhus University, in 2001-2007. These children are a subgroup of a previously used cohort [13]. The police requested all examinations on suspicion of exposure to child abuse, and cases were examined in the 2001-2013 period.

We drew the remaining 2,231 children from the general population for comparison, using time of abuse as the index date and matching each examined child to six children of comparable age and sex. Children of divorced parents were over-sampled to adjust for this childhood adversity. We removed siblings from the analysis, leaving the child with the longest follow-up time. The final sample included 2,573 children.

We followed up on all children, drawing on registry data from national databases. Inter-registry record linkage was achieved using a unique personal identifier common to both registries and case files.

Outcomes

The definitions of outcomes and references to the literature that inspire the definitions are presented in **Table 1**.

TABLE 1 Definitions of outcomes.

Outcome	Categories	Source	Comments
School absenteeism	Total number of days with non-attendance during all school months	Danish Education Registers	-
Severe non-suicidal self-injury	No severe non-suicidal self-injury Severe non-suicidal self-injury	Danish National Patient Register	Self-harm resulting in death is excluded from this category, assuming possibly differing aetiology[a] We included ICD-10 codes X60-X84 and Y87, including diagnoses Also, accidents coded as self-harm (codes starting with EUW[b]) were included The age cutoff for contributing risk time was inspired by Bem et al. [15]
Substance abuse	No substance abuse Substance abuse	Danish National Patient Register	Substance abuse was defined as any harmful use of substances, including alcohol and drugs We included ICD-10 codes: *Alcohol [16]* F10.0, F10.1, F10.2, F10.3, F10.4, F10.6, F10.7, F10.8, F10.9, T51.0, T51.9, K85.2, K86.0, E24.4, G31.2, G62.1, G72.1, I42.6, K29.2, O35.4, P04.3, Q86.0, Y90.6, Y90.7, Y90.8, Y91.2, Y91.3, Z50.2, Z71.4, Z72.1, K70, X65, Y15 *Drugs and related substances [17]* F13.1, F13.2, F13.3, F13.4, T43.6, T43.8, O35.5, R78.2, R78.3, R78.4, Z71.5, Z72.2, F11, F12, F14, F15, F16, F18, F19, T40
Number of offspring	Number of offspring	Danish Central Civil Register	-

a) For further discussion, see [14].
b) The European accident coding system.

Exposures

For this study, we considered children examined for evaluation of exposure to child abuse as exposed. Exposure was classified based on the reason motivating the police examination request and categorised as suspected physical child abuse, suspected sexual child abuse, other suspicion of abuse and suspected multiple types of abuse. We categorised children from the general population as having no suspicion of exposure to abuse. Data were insufficient for detailed models in some analyses. In these cases, we dichotomised suspected abuse status into suspected child abuse and no suspected child abuse.

Covariates

Some models were not adjusted for all covariates as only few children had exposures in the model. **Table 2** lists all covariates and their sources.

TABLE 2 Definitions of covariates.

Variable	Categories	Source
Age at inclusion	Continuous	Danish Central Civil Register
Gender	Male Female	Danish Central Civil Register
Maternal education[a]	Missing data Primary level Secondary level Higher certificate, degree level or higher	Population Education Register
Maternal education dichotomised[a]	Primary level or missing data Secondary level or more	Population Education Register
Separation before inclusion	No separation of parents Separation of parents	Danish Central Civil Register

a) A number of mothers in the data had no records of any completed education. According to Statistics Denmark, this may either be because they did not complete primary school or due to data error. As this group is potentially very heterogeneous and we did not have enough variables and observations to perform reliable imputation of missing values, they were given their own category.

Analysis

We used negative binomial regression to model school absenteeism and number of offspring as these outcome variables were count data and skewed towards counts of null. The Poisson regression was chosen for substance abuse and severe non-suicidal self-injury as these outcome variables were binary.

All analyses were offset with years of person time contributed by each individual, resulting in estimates of incidence rate ratios (IRR) for all outcomes and corresponding 95% confidence intervals (CIs). Robust Eicker-Huber-White standard errors were used for all analyses.

For the outcomes of self-injury and substance abuse, contribution of risk time stopped after the first occurrence of the outcome, after the death of a child or when observation ended. For the outcomes of school absenteeism and number of offspring, the contribution of risk time continued until the death of a child or the end of observation, allowing multiple counts for each individual.

We planned all analyses a priori and documented these analyses in an electronic document kept with the data. For the outcomes of severe non-suicidal self-injury and substance abuse, post hoc Poisson models were used to estimate the initially planned IRRs based on results and reviewer feedback. The R language was used for all analyses. The full, commented code is available on GitHub; see Supplementary Material 1.

For the outcomes of school absenteeism and number of offspring, contributed risk time did not start immediately upon inclusion. Some children were not yet attending school or had not reached an age where pregnancy was biologically plausible. We started risk time for these variables at first record of school attendance and on the 16th birthday, respectively. For these outcomes, waiting to adjust for covariates until risk time began would have increased the likelihood of changes in covariates being influenced by the exposure. For this reason, we adjusted for covariates at study inclusion.

Trial registration: not relevant.

Results

Baseline characteristics for all children are presented in **Table 3.** Within all subcategories, suspected child abuse was found to be prospectively associated with substance abuse. Suspected child abuse was also found to be prospectively associated with severe non-suicidal self-injury and with school absenteeism among children aged 0-3 years but not 4-7 years. Additionally, suspected child abuse was prospectively associated with an increased number of offspring among children examined at 8-11 years of age. Suspected sexual abuse but not suspected physical abuse or suspected multiple types of abuse was prospectively associated with an increased number of offspring among children examined at 12-16 years of age. See **Table 4** for further details and Supplementary Material 1 for individual analyses.

TABLE 3 Baseline characteristics for included children. The values are n.

Variable	0-3 years	4-7 years	8-11 years	12-16 years
Gender				
Male	167	106	91	101
Female	294	377	384	1,053
Maternal education				
Less than primary or missing data	10	-[a]	-[a]	17
Primary level	145	130[b]	130[b]	318
Secondary level	190	210[b]	220[b]	503
Higher certificate, degree level or higher	116	130[b]	130[b]	316
Separation of parents before inclusion?				
No	268	245	227	504
Yes	193	238	248	650
Suspected child abuse	70[b]	59	55	160[b]
Physical abuse	24	-[a]	-[a]	-[a]
Sexual abuse	42	52	48	140
Multiple types of abuse	-[a]	-[a]	-[a]	16

a) Rules from Statistics Denmark stipulate the removal of small cell counts to avoid identifiable data.
b) To avoid any identification of numbers removed, these counts were rounded to the nearest 10.

TABLE 4 Prospective associations between categories of children evaluated for exposure to child abuse and the outcomes[a].

Outcome and exposure	Age at evaluation for exposure to abuse, yrs	Incidence rate ratio (95% CI)	Cases/ participants, n	Individual risk time, median, yrs	Adjusted for covariates
Substance abuse					
Suspected physical[b]	10-16	7.15 (2.23-22.93)	111/1,398	11.3	Age at inclusion, gender, maternal education dichotomised, separation before inclusion
Suspected sexual[b]	10-16	4.14 (2.62-6.55)	111/1,398	11.3	-
Suspected multiple types[b]	10-16	3.94 (1.29-12.07)	111/1,398	11.3	-
Severe non-suicidal self-injury					
Suspected child abuse[b]	7-16	5.03 (2.59-9.77)	38/1,711	11.6	Age at inclusion, gender, separation before inclusion
School absenteeim[c]					
Suspected child abuse[d]	0-3	1.30 (1.01-1.68)	-/401	4.6	Gender, maternal education dichotomised, separation before inclusion
Suspected child abuse[d]	4-7	1.10 (0.85-1.42)	-/410	3.7	Gender, maternal education dichotomised, separation before inclusion
Offspring, n[e]					
Suspected child abuse	8-11	3.93 (2.14-7.22)	47/382	6.2	Separation before inclusion
Suspected physical abuse	12-16	1.21 (0.44-3.31)	292/1,053	9.4	Maternal education, separation before inclusion
Suspected sexual abuse	12-16	1.67 (1.27-2.2)	292/1,053	9.4	-
Suspected multiple types of abuse	12-16	1.46 (0.50-4.26)	292/1,053	9.4	-

CI = confidence interval.
a) For further details on individual models, see Supplementary Material 1.
b) Poisson model, all other models were negative binomials.
c) Risk time contributed starting at first record of school attendance.
d) Exposure time was contributed after 10 yrs of age [17]. This analysis compared counts of absence and, consequently, no case cutoff could be established.
e) Risk time contributed starting at 16 yrs of age; a case was defined as anyone with > 0 of offspring during follow-up.

Discussion

We found that evaluation for child abuse exposure was prospectively associated with substance abuse and severe non-suicidal self-injury. For school absenteeism and number of offspring, associations varied by age groups; for number of offspring, also by suspected type of abuse.

Strengths and limitations

This study represents a large cohort of children evaluated for exposure to abuse and prospectively followed up through registry data and compared with children from the general population. This is the first available prospective follow-up of school absenteeism after evaluation for exposure to child abuse, the first prospective assessment of the number of offspring in this group and the first prospective follow-up across a broad set of life trajectory indicators.

Due to sample size constraints, some models could be adjusted for only some planned variables. This may leave these models at risk of confounding. Nonetheless, it seems reassuring that most results align with expectations from previous studies.

Divorces before inclusion might be the result of current unreported child abuse. Adjusting for this might attenuate the effect of abuse in the analyses. According to Statistics Denmark, the variable used for divorces has known errors, but the errors are thought to affect only few persons in the sample. Thus, we had no information warranting any systematic data bias.

Our data source for diagnoses did not include diagnoses given during psychiatric inward treatment. Also, the

registry data used did not account for health conditions treated solely by family doctors. It follows that our information on self-injury and substance misuse is incomplete. However, self-injury and misuse cases with sufficient severity to warrant a hospital diagnosis would likely trigger a physical examination at an emergency department. They would, therefore, be diagnosed and included here. Consequently, we assume that most severe cases were included. As referral diagnoses were also included in the search for severe non-suicidal self-injury diagnoses, some false positives might arise, but this was accepted to avoid false negatives in the situation in which children referred for self-injury treatment were simply given a diagnosis corresponding to the harm inflicted but not describing the intent.

There were numerous absences in the school attendance data, for reasons unknown to us. In the 0-3- and 4-7-year age groups, 13% and 15% were missing, respectively, leaving sufficient data for analysis. However, more than half the records were missing among older children. Therefore, the data describing these age groups were not analysed. We found no plausible reason for the missing data while studying the original data set. The direction of any selection bias therefore remains unknown.

Interpretation

Our findings concerning substance abuse and severe non-suicidal self-injury are in line with previous literature on child abuse [5, 6]. Our data indicate that the findings may also apply to children evaluated for exposure to abuse, providing a further argument to assess the needs and offer services to all families reported to the social authorities [12].

We found that school absenteeism was increased among children aged 0-3 years at the time of examination but not among children aged 4-7 years. Absenteeism may indicate a negative impact on child resources among the children examined resulting from abuse or risk factors preceding and co-existing with abuse. As previously stated, a lack of prospective data on this is evident in the literature. The models were not powered to analyse sub-categories of suspected child abuse. The age group differences might be caused by differing effects on child development in different age groups and by underlying differences in child abuse categories. However, various other factors that could influence school absenteeism or modify the effect of abuse, e.g., social support [7] or low parent-school involvement, were not accounted for in the model and may have had different influences in different age groups. Also, differences in schooling approaches and culture between the studies mentioned may warrant caution when extending conclusions to other school systems. Further data and tests are needed to analyse this.

We found that the number of offspring was increased among children examined at 8-11 years old and among children 12-16 years old with suspicion of sexual child abuse. The association among children 8-11 years old may be driven by suspicion of sexual abuse, but the number of observations did not allow for such subgroup analysis. This result is a first in the literature but aligns with earlier studies reporting an increased risk of adolescent pregnancy among victims of child abuse [9]. Child sexual abuse seems to increase the number of offspring early in the lives of the victims. Possible explanations for this include an increase in sexual risk behaviour among women who have experienced childhood sexual abuse. In our results, the association was unique to evaluation for sexual abuse, as was the case for previous literature on sexual risk behaviour [19]. Following Cassin as cited by Palmer [20], an alternative explanation is that childbearing might represent an attempt to heal the trauma of sexual abuse. This is in line with our own anecdotal evidence from clinical practice. Nonetheless, our data do not allow for further exploration of these hypotheses. Children born to mothers who have experienced abuse may need support, based on any adverse consequences of abuse experienced by their parents.

Conclusions

Prospective associations were found in some groups across all outcomes measured. This underlines that children examined for exposure to child abuse carry an increased risk of various future adverse outcomes. It is important to raise awareness among health professionals and social services of this risk in the affected group of children and the families that they subsequently form.

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References can be found with the article at ugeskriftet.dk/dmj

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