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Growing up in the shadow of domestic violence: Evidence from register data

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Abstract

Children who are indirect victims of domestic violence can exhibit the same negative outcomes as children who are direct victims. This study investigated the consequences of children's exposure to domestic violence among parents on a range of children's outcomes: mental health, well-being, school performance and placement in out-of-home care. We used administrative records from full population cohorts of children in Denmark ($N = 399\ 519$, born 1997–2003). We examined a target group of children exposed to domestic violence and a comparison group not exposed to it, both groups having similar personal and family backgrounds, including pre-birth history of family domestic violence. To construct the comparison group, we used propensity score matching. Exposure to domestic violence had a substantial negative impact on academic performance (age 9–15), self-reported well-being in school (age 10–15) and also increased the likelihood of being placed in out-of-home care (age 9–15) and being diagnosed with post-traumatic stress disorder (age 9–15). The discounted additional cost (medical and child welfare system) per child indirectly experiencing domestic violence was at least $31 000 (age 0–15). Thus, our results show important adverse effects and suggest that earlier prevention and more preventive social interventions could help reduce the long-term consequences of childhood exposure to domestic violence.

KEYWORDS
administrative records, child outcomes, domestic violence, economic impact, indirect violence, matching

1 | INTRODUCTION

Domestic violence (DV) is a major public health issue and a problem of considerable social importance, given both its prevalence and the consequences for its victims. When DV takes place in families with children, these children can become indirect victims of that violence, even though they are not the direct object of the violence. Children can be part of a dispute or can consciously or unconsciously experience the results of violence on their parents or guardians, be they physical or psychological—for example, in the form of bruises, increased stress or crying. In the following, the term children's exposure to DV encompasses both situations when a child has consciously observed violence in the family and when a child has been unconsciously exposed to violence in the family (Black et al., 2020; Holden, 2003).

Previous research and systematic reviews have shown that children's exposure to DV may adversely affect their physical well-being

and health or their emotional response and cognitive functional outcomes (Felitti, 2009; Fong et al., 2017; Jaffe et al., 2003; McTavish et al., 2016; Sternberg et al., 2006; Yount et al., 2011). While several studies have focused on cognitive and behavioural outcomes among children exposed to DV (Hazen et al., 2006; Kitzmann et al., 2003; Wolfe et al., 2003), few have examined the long-term consequences of DV exposure on children's academic performance (Peek-Asa et al., 2007).

Several theories describe potential reasons for negative outcomes in school performance and mental well-being among children who are exposed to DV. First, according to developmental psychopathology theory, exposure to DV may disrupt the developmental tasks of specific stages and increases the risk of failure in later developmental tasks (Cicchetti & Toth, 1995; Margolin & Gordis, 2004). Thus, children developing within a maladaptive environment may not only have clinical or diagnosable outcomes but also encounter difficulties concentrating in school (Wolfe et al., 2003). Second, trauma theory recognizes that exposure to DV constitutes a highly stressful environment for children that may disrupt their brain development through an increased stress response (De Bellis, 2001; Eth & Pynoos, 1985). Such environments may lead to post-traumatic stress symptoms and altered cognitive functioning (Perry et al., 1995). Third, family system theory also addresses how DV reduces parents' available resources, skills and nurturing ability and leads to a lack of activities (e.g., reading) that can support academic achievement (McLoyd, 1998).

1.1 | This study

Using observational data from a Danish setting, this study examined the effects of children's exposure to DV on their mental well-being and educational outcomes in compulsory schooling ages.[1] We used a rich set of administrative records that were linked to schooling and mental health outcomes, which allowed us to design a cohort study with a control group to quantify the impact of exposure to DV on child outcomes.

We studied the effect of exposure to DV on children's mental well-being, specifically on the risk of increased post-traumatic stress disorder (PTSD), anxiety and depression. Children exposed to DV may exhibit PTSD (Lehmann, 1997), and anxiety and depression are also associated with DV (Chan & Yeung, 2009; Sternberg et al., 2006). Such mental health reactions in children can lead to learning difficulties and behavioural adaptation to their violent environment (Sternberg et al., 2006), both of which may, in turn, affect schooling outcomes (Romano et al., 2015).

We also examined measures of child well-being in school and school attendance (Fry et al., 2018; Hagborg et al., 2018), as we expected a negative impact on these. Likewise, we investigated the likelihood of being placed in out-of-home care for children exposed to DV, because children placed in out-of-home care tend to have poorer health and schooling outcomes than their at-home peers (Egelund & Lausten, 2009; Courtney & Dworsky, 2006).

1.2 | Contributions of the present study

Our study contributes in several ways to the literature on child exposure to DV. In contrast to previous studies, we used administrative data for full population cohorts, thereby providing population estimates of long-term outcomes. Moreover, to reduce selection bias, we included pre-birth history of exposure to DV and used matching techniques to target the effects as an observational study.

Furthermore, our study addresses the fact that few studies have used population-based samples to examine the long-term effects of exposure to DV on children's academic performance. One exception is Peek-Asa et al. (2007), who studied how exposure to DV affects standardized test scores (e.g., reading and math) in a prospective longitudinal cohort study conducted in one Iowa county, covering 306 children from age 6 through 17 years. We provide evidence on a larger sample with better control groups.

A further contribution of our study is that our data allowed us to identify long-term consequences for mental health, well-being in school, school attendance and out-of-home care placement. Finally, we illustrate the costs associated with children's exposure to DV.

2 | METHODS

2.1 | Sample

We used administrative records from Statistics Denmark covering the entire universe of children born in Denmark from 1997 to 2003 (399 519 children).[2] For these cohorts, we had administrative records for the period 1994–2013.[3] Denmark constitutes a valuable case study because high-quality Danish register data allow us to connect family members and to link information about health, education and family background to each child.

2.2 | Sociodemographic covariates

To follow individuals over time and link children to parents and siblings, we used anonymized personal numbers from the Danish Central Person Register that are assigned to all persons resident in Denmark. This feature enabled us to access a large set of pre-birth or at-birth characteristics of both family and child. We also measured DV in the child's family both before and after the child's birth.

2.3 | Definition of our measure of domestic violence

To identify DV in families with children, we used records from accident and emergency (A&E) departments and records on criminal assault charges. Our measure of DV relied on having at least one registered DV incident in the family, that is, at least one parent registered with either a criminal charge for violent assault (e.g., against a partner

or a spouse[4]) or recorded in A&E for a violence-related injury taking place in a residential area.[5] We excluded emergency treatments of the father for physical violence because they were not the result of violence by the mother (excluded after cross-validating them with the registry for victims of violence following criminal convictions). However, we included both the mother and the father for criminal charges.[6]

In sum, we placed a child in the target group if the family was recorded with at least one registered incident of DV from birth through age 8, and we used outcomes measured from age 9.

2.4 | Measures of child outcomes

We conducted separate analyses on the association between children's exposure to DV and school outcomes (standardized tests, score, self-reported well-being in school and school attendance), mental health diagnoses, and on out-of-home care and preventive measures by the social services. Not all outcomes were available for all birth cohorts (Table A2 provides an overview).

2.4.1 | Mental health measures

We considered three mental health outcomes: depression, anxiety and PTSD. The data on diagnoses came from the Danish Psychiatric Central Register. The register uses the International Classification of Diseases and constitutes a valuable tool in epidemiological research (Mors et al., 2011).[7] Diagnoses were registered either as acute emergency cases or through contacts with hospitals (admissions or outpatients) via referrals from general practitioners or specialists.

2.4.2 | Academic outcomes

We examined academic performance on the National Test (NT),[8] and exam grades from 9th grade (the final year of lower secondary school at age 15). The NTs are low-stakes, electronic adaptive and normed subject-specific tests. We focused on the test results in Danish (reading) and math.[9]

The 9th-grade exams were written, oral or both. Scores are given on a 7-point scale (−3; 0; 2; 4; 7; 10 and 12, with 2 required for passing).[10]

2.4.3 | Child well-being measures and school attendance

We used self-reported well-being in school from the National Well-being Survey from 2015 (Danish Ministry of Education, DME). This survey is a validated mandatory instrument administered annually in grades 4 through 9.[11] The survey comprises 40 questions, 29 of which are used by the DME for constructing four separate sub-indices of well-being and a general index of well-being.[12] The social well-being sub-index, constructed from 10 questions, covers the pupils' sense of belonging to their school, class and community, including feelings of safety and of being in a bully-free environment. The academic well-being sub-index, constructed from eight questions, covers the pupils' perception of their own academic ability, ability to concentrate and problem-solving skills. The support and inspiration sub-index, constructed from seven questions, covers the pupils' perception of their motivation and ability to influence the school day and of the support and help offered by teachers. The calm and order sub-index, constructed from four questions, covers the pupils' perception of teacher classroom management and of order and the noise level in the classroom. All four factors have a Cronbach's alpha coefficient >0.8, and the general index is constructed from all 29 questions (ibid.).[13] We standardized the scores in our analyses and only included children from target and control groups who had answered the questionnaire.[14]

The number of absentee days per year was registered when the pupil was in grades 7 to 9 (DME). Absentee days reflect both the well-being and the general health of the child. As teachers register absentee days, completion rates are high.

2.4.4 | Out-of-home care measures

We used the number of days per year that the child was placed in foster care and that the family received preventive measures from the social services.[15]

2.5 | Matching to reduce the selection bias

To reduce the selection bias when estimating the effect of a child's exposure to DV, we used a matching strategy. The identification problem was that we would not be able to observe the outcome of the controls had they been treated. The basic tenet of matching is the creation of two groups with identical covariate distributions. If the set of covariates adequately describes the selection mechanisms into the two groups, assignment conditional on this set is essentially random, and an estimate of the population average treatment effect is the difference in the average outcome in the two groups, in our case the average treatment effect on the treated (ATT).

Matching on a large set of covariates invariably leads to a dimensionality problem. Rosenbaum and Rubin (1983) have shown that, for matching on a one-dimensional index, the propensity score is sufficient. The propensity score equals the conditional probability that a child with covariates X is placed in the treatment group.

Propensity score matching is essentially a pre-processing sample selection tool aimed at creating, in our case, groups of children with a similar distribution of covariates. We estimated the propensity score with a logit and used the nearest-neighbour-matching algorithm for matching treated observations to controls. We then estimated the ATTs on the matched sample.

2.6 | The study design and family history of DV

We expected that family history of DV would be a strong predictor of future violence, and we used the panel structure of the data to condition on a history of family DV before the child's birth. This family history of DV is likely to capture the families' innate characteristics that are directly related to the risk of exposure to DV—characteristics that cannot be modelled in the absence of this information and that would likely bias the results. We therefore stratified our sample by pre-birth history of DV and birth year. We then used nearest-neighbour-matching within birth year pre-birth history of DV cells. Thus, we ensured that we compared pairs of children exposed (target) and not exposed (control) who were the same age in the same calendar year, had experienced the same pre-birth history of DV and had similar personal and family backgrounds. This allowed us to control for potential cohort effects that were unrelated to the effect of DV and for the risk of being exposed to DV.

Figure 1 shows the first DV occurrence in relation to the age of the family's first-born child aggregated across cohorts born 1997–2003.[16] The first DV often occurred before the birth of the child, followed by a drop in first DV around birth. After birth, the first DV mainly occurred during the child's first 3 years. Once the first-born reached 8 years, fewer than 200 families per cohort and per year were registered with a first DV occurrence.

Consequently, we defined a target child as a child whose family was registered with a DV event from child's birth through age 8. This inclusion criterion allowed us to both have a large number of families in the analysis and to investigate child outcomes from age 9. Figure 2 summarizes our design.

2.7 | The choice of the covariates in the propensity score

As the unconfoundedness assumption in matching is based on the hypothesis that all the relevant covariates are controlled for, selection of covariates is crucial. Exposure to DV is not a random event. Poor families and women are much more likely to be exposed to DV than their more advantaged counterparts (Aizer, 2011). There are also substantial differences in victimization rates in relation to race and ethnicity (Lauritsen & White, 2001) and mental health status (Desmarais et al., 2014). A large literature shows that people of low socio-economic status have worse health than their better-off counterparts, mostly explained by differences in access to healthcare, health behaviours (e.g., smoking and drinking), social status and stress. More educated women are less likely to smoke, more likely to initiate prenatal care early and have fewer children, in whom they invest more (Currie & Moretti, 2003). So parents' health status can also influence child health and affect our outcomes of interest. In addition, low socio-economic status families are more likely to live in high-crime, violent neighbourhoods, increasing their exposure to violence (Ludwig et al., 2001).

For children's later-life outcomes, Black et al. (2007) show that birth weight has a lasting impact on outcomes such as education and

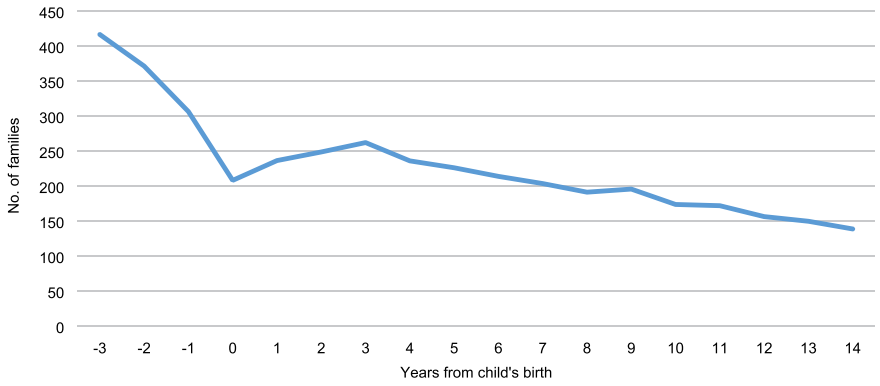

FIGURE 1 First registered occurrence of DV for family's first-born child. Notes: the Figure shows how old was the child when the family was first recorded with a DV event. Children birth cohorts 1997–2003. Sources: statistics Denmark.

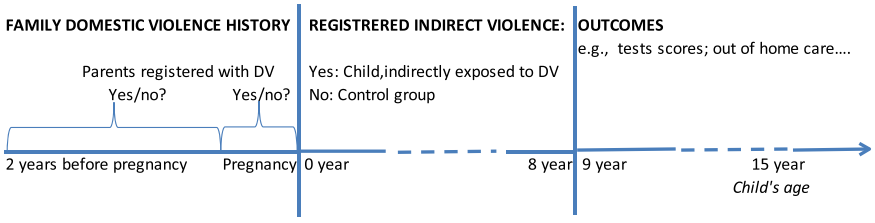

FIGURE 2 The study design. *Note*: The family domestic violence history includes four groups of parents, those for whom the violence occurred before and during pregnancy; those for whom the violence occurred before but not during pregnancy; those for whom the violence occurred during but not before pregnancy; and those with no violence registered before or during pregnancy. The study matches children according to their family history.

earnings, and Black et al. (2005) show that birth order influences children's education outcomes. Table 2 in Section 3.2 shows the range of child and family backgrounds we used in the propensity score matching. For the child, we included gender, birth weight and birth order, and for the family, we included background characteristics measured 1 year before the child's birth (e.g., health status, education and non-violent criminal records). We used municipality size and regional dummies for parental residence to roughly proxy neighbourhoods and capture possible differences in reporting DV in the registers because of distance to hospital or regional disparities in social programs targeting families at risk of DV.

2.8 | Testing for unobserved heterogeneity

We used Rosenbaum (2002) gamma sensitivity approach for binary treatments to examine the sensitivity of results to unobserved variables that could be correlated with both selection into treatment and the outcome of interest. This approach allowed us to determine how strongly an unmeasured factor must influence the selection process to turn a statistically significant finding into an insignificant one.[17] We performed this sensitivity analysis for all statistically significant ATTs.

3 | RESULTS

3.1 | Descriptive statistics pre-birth history of domestic violence

As previously mentioned, to reduce selection bias, we included the parental history of DV 3 years prior to the birth of the child, as women exposed to DV both before and during pregnancy are at risk of poor maternal and infant health outcomes (Silverman et al., 2006). Table 1 shows the number of children in relation to four types of history of DV prior to the birth of the child: violence before and during pregnancy (VV); violence before but not during pregnancy (VN); violence during but not before pregnancy (NV); and no registered violence (NN). While families with DV both before and during the mother's pregnancy (VV group) accounted for the smallest number of children, two-thirds of these children were in the target group (244 children out of 358).

For the two other groups with violence before the child's birth (VN and NV), about 30% were subsequently exposed to DV when the child was aged 0–8. Children with no previous family history of DV (NN) constituted the largest group of children in the target group. Over 16 000 children—about 2300 children per birth cohort (or 4%)—were exposed to DV even though the family had not previously been registered for DV.[18]

3.2 | Sample characteristics and covariate balancing

Table 2 shows the covariate balancing of the target and control groups. While the means of the observable characteristics of the target and control groups were very different before matching (e.g., mother age at birth: 30.3 years in the control group and 27.6 in the target group before matching, and 27.6 years in both groups after matching), they became well balanced after propensity score matching. The last column of Table 2 shows that the differences between the control and target groups were small and usually non-significant. However, as the common support requirements were not fulfilled for the VV group, we excluded them (358 children; 244 in the target and 114 in the control) from the matching.

3.3 | Average treatment effect on the treated

This section presents the effects of being exposed to DV on the different outcomes of interest: performance in school, self-reported well-being in school and days absent from school, mental

TABLE 1 Number of children by pre-birth history of domestic violence.

Pre-birth history of domestic violence			Pre-birth domestic violence history for target and control group		
Groups of pre-birth history of domestic violence	Two years prior to mother's pregnancy	During mother's pregnancy	Target	Control	Total
VV: Domestic violence before and during pregnancy	Yes	Yes	244	114	358
VN: Domestic violence before but not during pregnancy	Yes	No	1636	3770	5406
NV: Domestic violence during but not before pregnancy	No	Yes	428	856	1284
NN: No pre-birth registered domestic violence	No	No	14 170	378 301	392 471
Total			16 478	383 041	399 519

Note: Children were placed in the target group if at least one event of domestic violence (DV) was registered when the child was aged 0–8, a child not exposed to such DV was placed the control group. V means violence and N no violence. VV means that the violence occurred before and during pregnancy; VN means that the violence occurred before but not during pregnancy; NV means that the violence occurred during but not before pregnancy; and NN means that no violence was registered before or during pregnancy.

TABLE 2 Background characteristics of control and target groups, before and after matching.

	Before matching				After matching			
	Control		Target		Matched sample			
	Mean	*N*	Mean	*N*	Mean	SD	*N*	Difference
	Child characteristics at birth							
Birth weight (g)	3516	379 532	3374	16 107	3.375	640.6	30 512	1.19
Child's birth order	1.8	382 927	2.0	16 234	2.0	1.1	30 512	−0.04**
Gender	0.5	382 927	0.5	16 234	0.5	0.5	30 512	−0.00
	Parental characteristics 1 year before birth							
Parents living together 1 year before birth	0.85	382 927	0.6	16 234	0.6	0.5	30 512	−0.00
Mother's age at birth	30.3	382 398	27.6	16 174	27.6	5.4	30 512	−0.17**
Danish mother	0.9	382 927	0.8	16 234	0.9	0.4	30 512	0.01*
Danish father	0.9	382 927	0.8	16 234	0.8	0.4	30 512	0.01
Mother's income below 50% of the median	0.05	382 927	0.2	16 234	0.2	0.4	30 512	0.00
Mother's education (more than basic)	0.8	382 927	0.3	16 234	0.4	0.5	30 512	0.00
Father's education (more than basic)	0.7	382 927	0.4	16 234	0.4	0.5	30 512	0.01
Mother receiving social benefits	0.3	382 927	0.6	16 234	0.6	0.5	30 512	−0.00
Father receiving social benefits	0.2	382 927	0.6	16 234	0.5	0.5	30 512	0.01
Mother with psychiatric diagnosis	0.02	382 927	0.08	16 234	0.1	0.3	30 512	0.00
Father with psychiatric diagnosis	0.01	382 927	0.06	16 234	0.1	0.2	30 512	0.00
Mother hospitalized for a somatic disease	0.2	382 927	0.4	16 234	0.4	0.4	30 512	−0.00
Father hospitalized for a somatic disease	0.1	382 927	0.3	16 234	0.3	0.4	30 512	−0.00
Mother convicted (non-violent crime)	0.04	382 927	0. 2	16 234	0.2	0.4	30 512	0.01
Father convicted (non-violent crime)	0.1	382 927	0.5	16 234	0.5	0.5	30 512	−0.01
	Geographical characteristics							
Municipality size (population)	53 924.4	382 927	60 339.4	16 234	58 215.1	87.6	30 512	120.7
Mother living in the capital region	0.3	382 927	0.3	16 234	0.3	0.4	30 512	−0.00
Mother living in region Sealand	0.0	382 927	0.04	16 234	0.0	0.2	30 512	0.00
Mother living in region South Denmark	0.1	382 927	0.1	16 234	0.1	0.3	30 512	0.00
Mother living in region Mid-Jutland	0.13	382 927	0.1	16 234	0.1	0.3	30 512	0.00
Mother living in region North-Jutland	0.05	382 927	0.04	16 234	0.04	0.2	30 512	−0.00
Father living in the capital region	0.3	382 927	0.3	16 234	0. 3	0.4	30 512	−0.00
Father living in region Sealand	0.03	382 927	0.04	16 234	0.04	0.2	30 512	0.00
Father living in region South Denmark	0.09	382 927	0.1	16 234	0.1	0.3	30 512	0.00
Father living in region Mid-Jutland	0.1	382 927	0.1	16 234	0.1	0.3	30 512	0.00
Father living region North-Jutland	0.05	382 927	0.04	16 234	0.04	0.2	30 512	−0.00

Note: We stratified on year of birth and DV history (VN, NV and NN), and used nearest neighbour matching with a logistic specification for the other factors with replacement (psmatch2 in Stata). We excluded the VV group shown in Table 1 (358 children) as it was not possible to find a match for the 244 children in the target group. Variables in the table were used in the propensity score estimation.
Abbreviations: *N*, number of observations; SD, standard deviation.
*$p < 0.10$, and **$p < 0.05$.

health outcomes, and out-of-home care and preventive social measures. Table A4 compares the outcomes for the control and target groups to the rest of the population. It provides the number of children and mean for each outcome and shows that both the control and target groups belong to the lower end of the distribution.

3.3.1 | Effects on schooling outcomes

We examined the consequences of being exposed to DV for the child's performance in the NTs and for the 9th-grade tests in Danish (reading) and math.[19] Table 3 shows that across grades and subjects, the effect size was about 0.1 standard deviation ($p < 0.001$). The population

distribution of scores reveals that the average performance of the control group in Danish corresponded to the 37th, 33rd, 34th and 32nd percentile for the grades 2, 4, 6 and 8, respectively. The average results of the target group were lower, corresponding to the 33rd, 30th, 30th and 29th percentile for the grades 2, 4, 6 and 8, respectively. The effect of growing up with parental DV led to a performance gap of about 3 to 4 percentiles. We found a similar pattern for math, with the largest effect in the 6th grade—a performance gap equivalent to about 5 percentiles.

Table 3 also shows the results on 9th-grade tests in Danish and math. The effects were somewhat greater for math (−0.50 grade points, $p < 0.001$) than for Danish (−0.34 grade points, $p < 0.001$). The effect sizes expressed as standardized mean differences were 0.13 ($p < 0.001$) and 0.17 ($p < 0.001$) for Danish and math, respectively. Compared with the population distribution of 9th-grade results, the mean of the control group corresponded to the 34th percentile, while the mean of the target group corresponded to the 31st percentile. Thus, the performance of children exposed to DV was on average 3 percentiles lower than one would expect had they not been exposed to DV. The difference was larger for math, with the control group mean corresponding to the 33rd percentile, and the target group mean corresponding to the 27th percentile, on average 6 percentiles lower.

3.3.2 | Well-being in school and days absent from school

Table 4 shows the impact of being exposed to DV on children's well-being in school and days absent from school. Well-being was measured on a scale of 1 (*worst*) to 5 (*best*). We found statistically significant effects ($p < 0.001$) on all five well-being indicators (social, academic, support and inspiration, calm and order, and general well-being). We found that being exposed to DV led to a decrease in

TABLE 3 Results on academic performance measured on the NTs and 9th-grade tests.

	National Tests (NT)						9th-grade exams	
	Danish (reading only)				Math			
	Grade 2	Grade 4	Grade 6	Grade 8	Grade 3	Grade 6	Danish Grade 9	Math Grade 9
Target group	−0.37	−0.39	−0.39	−0.35	−0.39	−0.47	5.51	5.03
N	5255	8904	9871	5717	7082	9,83	3371	3329
Control group	−0.28	−0.30	−0.28	−0.27	−0.30	−0.36	5.85	5.53
N	5255	8904	9871	5717	7082	9.83	3371	3329
ATT (target minus control)	−0.10***	−0.10***	−0.10***	−0.09***	−0.10***	−0.12***	−0.34***	−0.50***
N	10 510	17 808	19 742	11 434	14 164	19 660	6742	6658

Note: Estimations were made separately by subject and grade level. Target group: children exposed to domestic violence (DV) while aged 0–8, Control group: children not exposed to DV while aged 0–8 years. National tests' results show standardized scores (z-score with mean 0, standard deviation 1) for birth cohorts 1997–2003. Results for 9th-grade exams show average scores for birth cohorts 1997–1999. Danish includes writing, spelling, as well as reading. N represents the number of observations. All results clustered at the mother level. The difference provides the average treatment effect on the treated (ATT).
***$p < 0.001$.

TABLE 4 Results on well-being at school and days absent.

	Well-being, scale 1–5					
	Social	Academic	Support and inspiration	Calm and order	General well-being	Days absent
Target group	3.92	3.34	3.13	3.60	3.53	53.8
N	6951	6939	6924	6937	6953	3628
Control group	3.98	3.40	3.17	3.63	3.58	46.7
N	6951	6939	6924	6937	6953	3628
ATT (target minus control)	−0.05***	−0.06***	−0.04***	−0.03**	−0.05***	7.1***
N	13 902	13 878	13 848	13 874	13 906	7256

Note: Well-being was measured with the Danish National Well-being Survey for 4th through 9th grades, split into five well-being sub-indicators. Absence was measured as the total number of days of absence in 7th–9th grades. Target group: children exposed to domestic violence (DV) while aged 0–8. Control group: children not exposed to DV while aged 0–8 years. Birth cohorts 2000–2003 were included in the sample estimation for the well-being measures and birth cohorts 1997–2000 were included for school absence. N represents the number of observations. The well-being measures were from the 2015 National Well-being Survey from the Ministry of Education. Well-being was measured on a scale from 1 (*low*) to 5 (*high*). Absence was measured in number of days absent in the 7th–9th grades. We also clustered at the mother level. The average treatment effect on the treated (ATT) was the difference between the target and control group.
**$p < 0.01$, and ***$p < 0.001$.

self-reported well-being of between 0.03 and 0.05 units on the well-being scale, depending on the well-being indicator analysed. For general well-being, the effect was −0.05 units, corresponding to an effect size (standardized mean difference) of 0.1 of a standard deviation. Compared with the distribution of reported well-being for the entire population, the control group's average well-being was approximately equivalent to the 38th percentile, while the target group's was equivalent to the 36th percentile.

We found larger effects for days absent from school. The target group had about 7.1 more accumulated absence days for 7th–9th grades than the control group, as measured in 2015. This result was equivalent to a standardized effect size of 0.16. Compared with the distribution for the entire population of children, the control group's absence day average corresponded to the 78th percentile, while the target group's average corresponded to the 83rd percentile.

3.3.3 | Mental health outcomes

Table 5 reports the impact of growing up in a family with DV on psychiatric diagnoses (PTSD, anxiety or depression) measured at age 9–15 years. The dependent variable was a binary indicator of whether the child had been diagnosed during those ages.

We found significant effects ($p < 0.001$) for being registered with a PTSD diagnosis. The risk increased by 1.1 percentage points, that is, a 50% increase at the mean compared with the average in the target and control groups (2.2%, see Table A4). We found no significant effects ($p > 0.05$) for depression or anxiety, both of which had a much lower prevalence than PTSD in our sample and in the child population in general (0.4% to 0.5% for depression and 0.2% for anxiety, see Table A4). We believe this non-finding was related to the fact that, while children often show misery or frustration, they rarely produce specific complaints or symptoms equivalent to those that characterize adult disorders, so they may therefore not be registered with such diagnoses (WHO, 1993).

TABLE 5 Results on mental health outcomes (PTSD, anxiety and depression).

	PTSD	Anxiety	Depression
Target group	2.8	0.25	0.46
N	6782	6782	6782
Control group	1.7	0.13	0.47
N	6782	6782	6782
ATT (target minus control)	1.1***	0.12	−0.02
N	13 564	13 564	13 564

Note: Percentage of children registered with a diagnosis while aged 9–15 years. The effect was calculated by comparing children aged 0–8 years exposed to domestic violence (DV) (target) with a comparable group of children who were not exposed to DV while aged 0–8 years (control). Birth cohorts 1997 to 1999 were included in the sample estimation and we had data up to year 2014. N represents the number of observations. The dependent variable is a binary indicator for being registered with a given psychiatric disorder. We also clustered at the mother level. The average treatment effect on the treated (ATT) was the difference between the target and control group.
***$p < 0.001$.

3.3.4 | Out-of-home care and preventive social measures

Table 6 shows the impact of being exposed to DV on the likelihood of the child being placed in out-of-home care (panel A) or of being subject to preventive social measures (panel B), both by age and for the age span 9–15 years.

Panel A shows that the age-specific likelihoods for the target group were generally 3 to 5 percentage points higher than for the control group ($p < 0.001$), whereas this likelihood for the interval 9–15 years was almost 6 percentage points higher than for the control group ($p < 0.001$). As the average for the control and target groups was about 9% (Table A4), it corresponded to an increase in likelihood of 64% at the mean. The corresponding odds ratio was 2.06, that is, 106% greater odds for the target group to be placed in out-of-home care.[20]

Table 7, Panel B, shows that, in general, children exposed to DV had a 5.7-percentage-point (p-value < 0.001) greater likelihood of receiving preventive social measures while aged 9–15. The odds ratio was 1.67, meaning that a child who was exposed to DV while aged 0 to 8 had on average 67% higher odds of receiving a preventive social measure between ages 9 and 15 than those of a child who had not experienced DV.

3.3.5 | Sensitivity analysis with Rosenbaum bounds

Our sensitivity analyses for all statistically significant ATTs showed that the critical values for which the statistically significant ATT would become statistically indistinguishable from zero varied between 1.1 and 2.0 (Table A5). A critical value of 1.1 or 1.2 means that a hypothetical unobserved variable, such as a mother's personality or the strength to leave one's partner, would need to have an odds ratio of 1.2 to completely determine the outcome for the matched children pairs and overturn our ATT estimate.

In our sample, the odds ratio of the *mother's household income below 50% of the median 1 year before birth* was 1.13 and for the *mother's somatic (non-psychiatric) disease* it was 1.23. Consequently, to challenge our conclusions, an unobserved factor would have to be stronger than, for example, the effect of changing the probability of the mother having a household income 50% below the median from 0% to 100%. Thus, we can conclude that our effects are robust to hidden bias.

3.3.6 | The economic burden of violence

We calculated the additional societal costs resulting from children exposed to DV by comparing the expenditures in the target and

TABLE 6 Results on the likelihood of out-of-home placements and preventive social measures.

	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	At least once between (9–15 years)
Panel A. Placed in out-of-home care								
Target group	6.1	6.6	7.3	7.9	8.7	9.6	10.3	11.7
Control group	2.7	3.0	3.2	3.8	4.3	4.7	5.4	6.0
ATT (target minus control)	3.4***	3.6***	4.1***	4.1***	4.3***	4.9***	5.0***	5.7***
Panel B. Preventive social measures								
Target group	5.7	6.2	6.3	7.0	7.9	9.0	8.9	15.8
Control group	3.5	3.7	3.9	4.3	4.9	5.8	5.9	10.1
ATT (target minus control)	2.2***	2.4***	2.3***	2.7***	3.0***	3.3***	2.9***	5.7***
N target group	15 256	15 256	13 203	11 174	8999	6782	4566	4566
N control group	15 256	15 256	13 203	11 174	8999	6782	4566	4566
N total	30 512	30 512	26 406	22 348	17 998	13 564	9132	9132

Note: Percentage of children placed out-of-home at different ages, and at least once between ages 9–15 years. The effect was calculated by comparing children exposed to domestic violence (DV) while aged 0–8 years (target), with a comparable group of children not exposed to DV while aged 0–8 years (control). Birth cohorts 1997 to 2003 were included in the sample estimation. However, only children for birth cohorts 1997 and 1998 reached age 15 in our analysis period up to 2013. N represents the number of observations. The dependent variable is a binary indicator for a child being placed in out-of-home care during the period. We also clustered at the mother level. The average treatment effect on the treated (ATT) was the difference between the target and control group.
***$p < 0.001$.

TABLE 7 Total expenditure related to children exposed to DV (target group) and a control group aged 0–15 years, by type of expenditure in thousand USD.

	N	Units (no. of days/contacts)	Price ('000 *USD*)	Expenditure	Total ('000 USD)
Out-of-home placements					
Target group	659	2251 (69)	0.163 (0)	369 (11)	243 099
Control group	334	2222 (1216)	0.165 (0)	364 (20)	121 645
Preventive social measures					
Target group	900	1007 (32)	0.111 (0)	94 (4)	101 107
Control group	538	1169 (61)	0.111 (0)	130 (7)	70 190
Hospitalizations (somatic)					
Target group	3244	10 (0.3)	1.905 (0.03)	13 (0.5)	42 792
Control group	3105	11 (0.6)	1.905 (0.03)	16 (1.3)	50 692
Outpatient treatments (somatic)					
Target group	4363	11 (0.2)	0.222 (0.002)	3 (0.1)	11 790
Control group	4309	10 (0.3)	0.238 (0.002)	3 (0.1)	11 861
Total					
Target group	4566				398 789
Control group	4566				254 388
Difference (target minus control)					144 401

Note: Standard deviation in parentheses. Estimated for birth cohort 1997–1998. Groups: VN, NV and NN were included in the analysis. Cost deflated to 2015 DKK and converted to USD exchange rate 1 USD = 6.3 DKK.
Source: Authors' own computations using national patient register rates for hospitalizations (LPRDRG) and outpatient visits (LPRDAGS). Children and adolescent out-of-home care (BUA) and preventive measures (BUFO).

control groups. Our calculations included children born in 1997 and 1998, as we could follow these cohorts until they were 15. All costs were deflated to 2015 DKK and converted to USD using exchange rate 1 USD = 6.3 DKK.

Table 7 shows the expenditures for the four selected categories (out-of-home placements, preventive social measures, hospitalizations and outpatient treatment) and provides the total expenditure for each category for ages 0 through 15 years. The table shows no real

differences between the target and control groups in the average number of days that children were placed in out-of-home care (2251 and 2222 days, respectively). However, an important difference appeared in the likelihood of being placed in out-of-home care; about twice as many from the target group (659) were placed in out-of-home care compared with the control group (334). The total cost for the target group (over $243 million) was therefore nearly double that of the control group.

A similar pattern was seen in the cost of preventive social measures: 900 children in the target group received preventive measures, compared with 538 in the control group. Overall, the additional cost for the target group was almost $31 million ($101 million vs. $70 million).

For hospitalizations, Table 7 shows that although only slightly more children in the target group had been hospitalized (3244 in the target group vs. 3105 in the control group), their hospitalizations were on average slightly shorter (10 days in the target group vs. 11 in the control group). This difference gave a lower cost for the target group of about $US 8 million.

For outpatient contacts, Table 7 shows no significant differences either in terms of how many children had outpatient contacts (4363 in the target group against 4309 in the control group) or in terms of their average number of contacts (11 on average in the target group and 10 in the control group). Consequently, the total expenditure for each group was about $12 million.

Overall, Table 7 shows that for the four types of expenditures, the total expenditure for children in the target group amounted to $399 million, compared with $254 million in the control group. The total additional cost, from birth through age 15, of being exposed to DV was about $144 million or about $77 million per cohort. The discounted additional costs per child were at least $31 000.

4 | DISCUSSION

This study investigated the consequences of children's exposure to DV by using a matched control group. Both target and control groups represented socially vulnerable families. We show that, relative to children in the control group, children exposed to DV were even more vulnerable in a wide range of areas, such as mental health and schooling outcomes. Children exposed to DV were twice as often placed in out-of-home care and one and half times more often diagnosed with PTSD than their matched control group, confirming the relationship between exposure to DV and PTSD diagnosis (Lehmann, 1997).

Similarly to Fry et al. (2018), we found significant effects of being exposed to DV on children's academic performance in school. Children exposed to DV performed worse in 9th grade than those in their matched control group (3 to 6 percentiles worse for reading and math, respectively). The effect size was about 0.1 standard deviation, which according to Kraft (2020) is substantial. As in Peek-Asa et al. (2007), we also found that the standardized test score reductions were greater for math than for reading. Regarding school absence days, we found that children exposed to DV have seven more absent days on average than their controls, confirming the relationship between maltreatment and absenteeism (Hagborg et al., 2018).

The above findings are consistent with theories on psychopathology, trauma and family systems, as well as with the increasing evidence that early-life events have important consequences on the development of both cognitive and non-cognitive skills (Cunha et al., 2010).

We found that 4% of children were registered as exposed to DV between ages 0–8. Although our register-based estimate is close to results from Danish studies using nationwide representative surveys for youth aged 14–15 years with 3% for Korzen et al. (2010) and 4% for Oldrup et al. (2016), both these studies reported last-12-months experiences and may therefore underestimate the cumulated prevalence. A Swedish study showed that more than 10% of young people aged 13, 15 and 17 had experienced violence between primary caregivers during childhood (Annerbäck et al., 2010), and Myhre et al. (2015) reported a prevalence of 3% for 16- 1to 7-year-olds in Norway.

If our register-based prevalence constitutes a lower bound, the average additional discounted cost per child from birth through age 15 of at least $31 000 we found is probably underestimated. Moreover, as our results strongly suggest that children's exposure to DV has adverse effects on schooling outcomes, and given that poor schooling outcomes are usually associated with increased crime rates, unemployment and poor health (Cutler & Lleras-Muney, 2010; Lochner & Moretti, 2004), we can therefore expect additional costs after age 15.

4.1 | Potential bias

We have identified four types of potential bias. First, because our definition of DV cannot include all possible incidents of violence that a child might be exposed to, our classification likely resulted in having some children categorized as not being exposed to DV in early childhood, even though they had been. Second, as our exposure was defined as at least one DV incident during the child's first 8 years, some children who were later exposed to DV will be classified as controls.[21] These two misclassifications will tend to downward bias our results if these misclassified children were adversely affected. Likewise, we were not able to consider the effect of the timing of the DV with regard to the timing of the measured outcomes, especially if new exposure to DV occurred just before a school test. Similarly, we did not include the mental health diagnoses registered before age 9, and mental health diagnoses are likely to be underreported.

A third potential bias is that children exposed to DV may also suffer directly from child abuse. In our population-based sample, we found a co-occurrence rate of child abuse and DV of 2.5% (in representative community samples, Appel & Holden, 1998 reported a 6% co-occurrence rate).[22] Some studies (Hughes et al.,

1989; Sternberg et al., 2006) suggest that the co-occurrence of child abuse and DV causes adverse effects on children (the "double-whammy" effect), which would tend to upwards bias the results. However, while the double-whammy effect has been supported in some studies (Hughes et al., 1989; Sternberg et al., 2006), it has been rejected in others (Sternberg et al., 1993), and only partly confirmed in a clinical sample (Hultmann et al., 2022). As argued by Hultmann et al. (2022), the conflicting findings when comparing the effects of single versus double exposure might result from the type of samples considered (clinical or population-based) and from the lack of control of potentially confounding factors such as the frequency of violence, the age at onset, or the violence outside the family. In our study, we could not account for all these confounding factors. While our register-based co-occurrence of child abuse and DV probably underestimates the true prevalence, we do not expect that it constitutes a substantial bias for our findings.

Lastly, another source of potential bias is unobserved heterogeneity. If unobserved variables simultaneously affect the probability of growing up in a family with DV and the outcome variables, the matching estimators will not be robust to such a *hidden bias*. Using Rosenbaum's (2002) gamma sensitivity approach, we found that unmeasured factors would have to be very strong to remove our effects. Thus, we expect that our results are robust to such unobserved heterogeneity.

4.2 | Strengths and limitations

The administrative records used in this study have a number of strengths and some limitations. One strength is that they allow us to examine an entire population and link data across multiple registers for different family members. In contrast, survey data can suffer from both selective non-response, which may be a threat to both external and internal validity, and from recall bias as respondents are asked retroactively about events. Nonetheless, the main limitation of administrative records is that not all violence is recorded, meaning that the results therefore constitute a lower bound for both the incidence of children exposed to DV and the range of the effect size. However, our definition of DV is likely to capture the more extreme cases of DV and might over-represent families in which women are the victims. Additionally, we do not measure or control for other forms of exposure to violence, for example, community violence, school violence or violence against other family members.

Another strength of this study is that it extends the concept of DV by showing that the consequences of growing up in its shadow—as indirect victims—are very similar to those of being the direct victims of DV. Although not all violence is registered, we had access to information on DV events occurring when the child was very young (from birth) and whether the child was registered as a direct victim. Moreover, given the Danish institutional setup—which includes free access to A&E and subsequent care—we are likely to identify a larger subset of the affected population than one can identify in other countries, because of the barriers that often prevent certain subpopulations from appearing in administrative records (Aizer, 2011).

However, in contrast to countries, such as the USA, our estimates of the consequences of children's exposure to DV are likely to be underestimated, because Denmark has a well-developed social welfare system, with a number of social policies for addressing and curbing some of the consequences of being exposed to DV and since 2002 has had action plans for the prevention of violence against women.

5 | CONCLUSION

This study constitutes one of the few register-based studies examining the impact on children of growing up in the shadow of violence. We show the effect on children's academic performance and well-being in school, mental health, and the likelihood of being placed in out-of-home care. Despite a substantial literature on DV and child outcomes, no previous studies have used panel register data for full birth cohorts to investigate the impact of growing up in the shadow of DV on academic school performance. Moreover, we are the first to calculate the societal cost associated with children indirectly experiencing DV in Denmark.

We show large societal costs of growing up with DV, with adverse effects on academic performance, well-being and mental health (more children diagnosed with PTSD), and an increase in placement in out-of-home care. At the same time, the results suggest that if prevention were provided earlier, it could improve the situation of the children at risk of being exposed to DV. Likewise, more preventive social interventions could help reduce the long-term consequences by decreasing both crime and social vulnerability. Future research should examine how children's exposure to DV affects outcomes related to crime and social vulnerability.

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CONFLICT OF INTEREST STATEMENT

None declared.

DATA AVAILABILITY STATEMENT

Raw research data are not shared due to privacy restrictions. More detailed description for accessing the data can be requested from the corresponding author.

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ENDNOTES

[1] In Denmark, while children must receive 10 years of compulsory education starting in August of the year they turn 6 years old, school attendance is not compulsory as parents can teach their children at home. However, the vast majority of children in Denmark attend municipal primary and lower secondary schools.

[2] We excluded children that could not be followed each year during at least 9 years from birth and children whose parents could not be followed each year from 3 years before the child's birth to the child was 8 years. In the follow up, we excluded the pair of control and target children, if their outcomes were missing, for example, in the well-being survey or because the children had left the country or died (respectively 0.5% and 0.03% of the 399 519 children).

[3] Table A1 shows which registers we used and for which years they are available. Table A2 provides an overview of which birth cohorts were used in the analyses. Table A3 provides the number of children by gender and birth cohort. We included all siblings in the family and clustered standard errors by mother.

[4] Available from the registry for criminal charges (KRSI) from Statistics Denmark from 1989 to 2013. Our classification captured all contact assaults, not just those perpetrated by domestic partners.

[5] Available from the LPR registry from Statistics Denmark (LPRPOP): The administrative records contain data on all contacts with hospitals and emergency rooms in Denmark from 1994 to 2014.

[6] Previous work has found that 90% to 95% of all violence against women is perpetrated by intimates (Balvig et al., 2013). For those seeking treatment for violence-related injuries at A&E, we considered only women, as Plauborg et al. (2012) estimate that only 10% of men seeking treatment for violence-related injuries per year at A&E were injured in a residential area.

[7] Studies of diagnoses in the register have shown high validity (Munk-Jørgensen & Mortensen, 1997; Mors et al., 2011, and Svensson et al., 2015).

[8] This test is mandatory for all public schools in grades 2 through 8, and optional for private schools. Children with learning difficulties are not required to take the tests.

[9] Each test results in a Rasch score for three cognitive areas called *profile areas*. For example, the reading tests assess language comprehension, decoding and reading comprehension. The skills level is estimated separately for each profile area of the subject (Beuchert & Nandrup, 2014, table 2.2). The Rasch score provides the estimate of student ability. We first standardized each profile test score, then calculated an average of the profile scores, then standardized again (see Beuchert & Nandrup).

[10] The tests are conducted in spring of the final year of lower secondary school. The test in Danish comprises both an oral and a written test. The test in math comprises a written test and sometimes an oral test (selection of pupils to oral tests is determined by lottery). The observed test scores are averages of the subject-specific scores.

[11] Mandatory in public and special-needs schools but optional in private schools.

[12] For the psychometric properties of the Danish student well-being questionnaire, see Niclasen et al. (2018) and a report from the Danish Ministry of Education: *Metodenotat og beregning af indikatorerne i den nationale trivselsmåling i folkeskolen* [Methodological report and calculation of the indexes in the national well-being survey in primary and lower secondary school], available at http://www.uvm.dk.

[13] The degree of association between the different sub-indices is larger than 0.37, and the association between the overall indicator and the sub-indices is >0.7.

[14] Niclasen et al. (2018) report that about 80% of all school-aged children in Denmark attend public schools and 85% of the students attending grades 4–9 in a public school have completed the survey for the school year 2014–2015.

[15] Both registers are available from Statistics Denmark.

[16] The same pattern is observed separately for each cohort. First-born child is used as an example; the rest of the analysis includes all children.

[17] To determine how strongly a hypothetically unobserved variable would have to affect the selection probability (odds ratio) to undermine the matching results, we estimated our model by gradually increasing the influence of the potential unobserved variable to a critical value such that the effect was no longer significant.

[18] In our sample, about 56% of the children belonged to families with only one incident during the period of 11 years we investigated, and 9% of the children were registered with more than five incidents during this period. The odds ratio for being exposed to more than one incident was very high if the family had a history of violence before the child's birth compared to a family who had no such history of violence. In our design, we could not investigate the dose–response to exposure to more than one violence event.

[19] The results were not driven by the NV group (children exposed to DV during but not before their mother's pregnancy) as excluding this group in the analysis did not change the results.

[20] Odds are calculated as (probability of being placed in out-of-home care)/(1 − probability of being placed in out-of-home care). The odds ratio is the odds treatment group divided by the odds control group.

[21] Sternberg et al. (2006) report that research suggested that exposure to DV in the formative years has worse consequences for child welfare.

[22] In a nationwide representative survey of 8th grade children in Denmark, Oldrup et al. (2016) reported a co-occurrence rate of 1% for last 12-month experiences.

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APPENDIX A

TABLE A1 Data sources used in the study.

Source	Registers/surveys	Description	Period
DST	PSYK	Danish Psychiatric Central Register	1994–2014
DST	LPRPOP	National Patient Register admissions	1994–2014
DST	KRSI	Criminal charges	1989–2013
DST	KRAF	Criminal verdicts	1989–2013
DST	KROF	Register of crime victims	2001–2013
DST	LPRDAGS	National patient register rates for outpatient visits	1994–2014
DST	LPRDRG	National patient register rates for hospitalizations	1994–2014
DST	BUA	Children and adolescents out-of-home care	Up to 2013
DST	BUFO	Children and adolescents preventive measures	Up to 2013
DST	VNDS	Migration to and from Denmark	1989–2013
DST	UDFK	9th grade (secondary school test)	Up to 2014
DST	NT	The National Tests	2010–2015
DME	Well-being survey	Well-being survey	2015
DME	School absences	Statistics about school absenteeism	2010 to 2014

Note: The present study was based on administrative records of the population in Denmark. We excluded children that could not be followed each year during at least 9 years from birth, and children whose parents could not be followed each year from 3 years before the child's birth to the child was 8 years. Abbreviations: DME, Danish Ministry of Education; DST, Statistics Denmark.

TABLE A2 Birth cohorts included in the analyses.

Analyses	Birth cohorts
Estimation of domestic violence	1997–2003
Personal consequences	
Mental health	1997–1998
Out-of-home care and social measures (9–15 years)	1997–2003 (1997–1998)
School performance 9th grade	1997–1999
School absenteeism	1997–2000
Well-being at school	2000–2003
School performance: National tests (NT)	1997–2003
Costs computations	1997–1998

TABLE A3 Number of children by birth cohort and gender.

Cohorts	Girls	Boys	*N*
1997	28 278	29 952	58 230
1998	27 784	29 472	57 256
1999	28 040	29 349	57 389
2000	28 177	29 742	57 919
2001	27 767	28 863	56 630
2002	27 016	28 590	55 606
2003	27 469	29 020	56 489
Total	194 531	204 988	399 519

TABLE A4 Descriptive statistics of outcome measures. Reported separately for the population of children, and for control and target groups.

			N	Mean	SD
Placement in out-of-home care (ages 9–15)		Population	115 392	0.018	0.13
		Control and target groups	9132	0.089	0.28
Preventive social measures (family) ages 9–15		Population	115 392	0.039	0.19
		Control and target groups	9132	0.129	0.34
Anxiety diagnosis (ages 9–15)		Population	172 733	0.002	0.04
		Control-and target groups	13 564	0.002	0.04
Depression diagnosis (ages 9–15)		Population	172 733	0.004	0.06
		Control and target groups	13 564	0.005	0.07
PTSD diagnosis (ages 9–15)		Population	172 733	0.011	0.10
		Control and target groups	13 564	0.022	0.15
Reported well-being in school	Social	Population	191 947	4.076	0.61
		Control and target groups	13 902	3.950	0.67
	Academic	Population	191 475	3.527	0.56
		Control and target groups	13 878	3.370	0.60
	Support and inspiration	Population	191 552	3.204	0.65
		Control and target groups	13 848	3.148	0.69
	Calm and order	Population	191 727	3.698	0.61
		Control and target groups	13 874	3.612	0.65
	General well-being	Population	191 877	3.663	0.47
		Control and target groups	13 906	3.552	0.51

TABLE A4 (Continued)

			N	Mean	SD
Days absent (through 7th–9th grade)		Population	101 844	34.914	33.49
		Control and target groups	7256	50.250	44.76
Secondary school 9th grade	Danish	Population	99 062	6.908	2.53
		Control and target groups	6742	5.681	2.51
	Math	Population	98 711	6.912	2.90
		Control and target groups	6658	5.278	2.93
Danish National Tests (DNT)	Danish, grade 2.	Population	142 452	0.016	1
		Control and target groups	10 510	−0.322	1.03
	Danish, grade 4.	Population	236 017	0.017	1
		Control and target groups	17 808	−0.348	1.09
	Danish, grade 6.	Population	265 788	0.044	0.98
		Control and target groups	19 742	−0.334	1.05
	Danish grade, 8.	Population	165 320	0.053	0.97
		Control and target groups	11 434	−0.311	1.07
	Math grade 3.	Population	190 035	0.013	1
		Control and target groups	14 164	−0.347	1.03

Note: Binary indicator for out-of-home care, preventive social measures and psychiatric diagnoses. Well-being was measured in 4th–9th grades in 2015 on a 1 to 5 scale.
Abbreviations: *N*, number of observations; SD, standard deviation.
Note: Absence day is the total number of absence days for Grades 7–9. NT are standardized by grade, subject and year.
Abbreviations: *N*, number of observations; SD, standard deviation.

TABLE A5 Sensitivity to selection effects. Rosenbaum bounds.

Panel A. School outcomes			
Danish National Tests (DNT)	Danish	Grade 2	1.2
		Grade 4	1.2
		Grade 6	1.2
		Grade 8	1.1
	Math	Grade 3	1.2
		Grade 6	1.2
Lower secondary school test	Danish	Grade 9	1.2
	Math	Grade 9	1.3
	General well-being		1.2
	Days absent		1.4
Panel B. Psychiatric diagnoses			
Hospital diagnoses	PTSD		1.5
	Anxiety		NS
	Depression		NS
Panel C. Placement in out-of-home care and preventive social measures			
	Placement in out-of-home care (age 9–15)		2
	Preventive social measures (age 9–15)		1.6

Note: Estimated with STATA rbounds.
Abbreviation: NS, non-significant.