Child Abuse & Neglect 98 (2019) 104150

Contents lists available at ScienceDirect

Child Abuse & Neglect

journal homepage: www.elsevier.com/locate/chiabuneg

Research article

Violent crime against children with disabilities: A nationwide prospective birth cohort-study

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ARTICLE INFO

Keywords:
Disabilities
Violence
Child maltreatment

ABSTRACT

Background: The rate of violent victimization against children with disabilities is thought to be lower than the rate for children without disabilities but several studies shows otherwise.
Objective: The study focuses on examining violent crime against children with disabilities and explaining differences in victimization, in order to elucidate to what extent types of disability, family disadvantages, gender, high-risk behavior, location and indicator of ethnic minority (e.g. non-Danish citizens) influence adolescents' risk of violent victimization. Previous population studies in this area lack scientifically sound research methodology and results are weak or inconclusive.
Method: Data is based on a national study of reported violent crime against children in Denmark aged between 7 and 18 years, using total birth cohorts (N = 678,000). Data on types of disability were collected from the Danish national inpatient register. Violent-crime data were extracted from Danish police records. Within the birth cohorts studied, 3.5% of children had experienced a violent crime. A discrete-time Cox model was used for the statistical analysis, which included an extended list of potential risk factors to adjust for confounding.
Results: Children with disabilities are more likely to be victims of a reported violent crime than non-disabled children – ADHD odds ratio: 2.7 (2.6–2.8), mental retardation: 2.7 (2.6–2.7), autism 2.6 (2.5–2.7), loss of hearing 1.4 (1.2–1.5), brain injury: 1.8 (1.7–1.9), physical disabilities 1.4 (1.2–1.5), and blindness 2.0 (1.4–2.8). Speech disability, epilepsy, stuttering, and dyslexia were not associated with increased risk of violent victimization, when adjusted for confounding risk factors and age.
Conclusions: The results of our study provide empirical insight into the first-time prevalence of victimization among children with disability, and into the predicative association between family disadvantages and victimization.

1. Introduction

A common misconception in the public debate assumes that adolescents with disabilities are among the most protected group of children (CRC,Committee on the Rights of the Child, 2011). However, statistics on crime against adolescents show that adolescents with disabilities have a higher risk of victimization than other adolescents (Fisher, Hodapp, & Dykens, 2008; Fitzsimons, 2009; Harrell, 2016; Jones et al., 2012; Leeb, Bitsko, Merrick, & Armour, 2012; Marge, 2003; Petersilia, 2001; Spencer et al., 2005; P. M. Sullivan & Knutson, 2000; P. M. Sullivan, 2009).

Many of the large-scale population studies on violent crime against children and adolescents lack scientifically sound research design and methodology. Crime victimization surveys and existing databases tend to lack information about risk factors (e.g. family vulnerability, poverty, family structure) during the years preceding a violent crime incident against children with disabilities. This insufficient knowledge on the causes and settings of such violence hampers the development of initiatives to prevent violence against

https://doi.org/10.1016/j.chiabu.2019.104150
Received 20 March 2019; Received in revised form 3 July 2019; Accepted 23 August 2019

children with disabilities.

Weaknesses in this field of research include poor standards for measurement of disability and violence, and insufficient assessments of whether violence preceded the development of disabilities. Only a small amount of research has been conducted on children and youths with disabilities who have been victims of conventional violent crimes, e.g. homicides, assaults, aggravated assault, and robbery (P. M. Sullivan, 2009, P. Sullivan, 2006). Furthermore, estimates in some studies might overestimate the association between violence and disability because of inadequate adjustment for confounding (Jones et al., 2012; Petersilia, 2001). There is a critical need for theory-driven research that uses criminal justice records, medical records, and reliable family and community risk variables to identify associations and pathways between child disabilities and engagement with delinquent-prone peers (Briere, 1996; P. M. Sullivan, 2009). The present study has avoided the above limitations by using prospective longitudinal methods and administrative data records. Our prospective study avoids the serious problem of recall bias, and illuminates the risk-factors in the situation preceding the first-time report of a violent crime, for children with and without disabilities. We hope our assessment of risk factors may help professionals to facilitate prevention and treatment interventions.

Previous studies estimate that children with disabilities have a significantly higher risk of being a victim of a violent crime. A systematic review and meta-analysis of 11 observational studies found the odds ratio for pooled risk estimates was 3.56 (95% CI 2.80–4.52) for physical violence against children with disabilities in comparison with children without disabilities (Jones et al., 2012). The systematic review confirmed that children with disabilities are more likely to be victims of violence than their peers who are not disabled; however, huge heterogeneity was identified between the studies. A further systematic review of population-based studies reporting empirical data on the association of child abuse and disability found that there is limited evidence that physical disability predisposes children to abuse (Govindshenoy & Spencer, 2007). Some studies select populations that might introduce biases that overestimate the level of violence children with disabilities are subject to. S These gaps need to be addressed through a whole population sample with standardized measures of disability and violence (Jones et al., 2012).

Despite the methodological flaws described above, a large number of studies indicate that violent victimization against children with disabilities is a problem of significant magnitude (Harrell, 2016; Marge, 2003; Spencer et al., 2005, P. M. Sullivan, 2009).

Our study collects data and information related to violence against children with disabilities. This knowledge can be useful for formulating national violence prevention policies and programs. Our study examines the risk factors that precede someone becoming a victim of violence, and compares children with and without disabilities. To solve the problem of heterogeneity in definitional paradigms for disabilities within the fields of education, health care, and mental health settings, we use a definitional paradigm for inpatient registers that uses the WHO classification (ICD-10) (WHO, 1994).

The best way of studying victimology is using longitudinal panel designs to study temporal causal ordering. Regrettably, longitudinal panel data are rarely available (Hope, 2007), and etiological explanations are often based on cross-sectional sample surveys. Previous studies of violence have mainly been based on self-reported victim surveys or studies of offender populations, which also suffer from risks of selection biases. To avoid these methodological problems, we have based our study on total birth cohorts using the Danish Registry System. This allows us to follow total birth cohorts from birth to early adulthood and compare victims of violence with the remaining part of the contemporary birth cohorts of the same age. These large panel data are unique.

Social-ecological theories struggle with the ecological fallacy – that is, characteristics of society cannot be used to infer characteristics at the individual level (Robinson, 1950). The present study studies victimization at the individual level, but includes structural factors such as living in a disadvantaged area. To disentangle the influence of living in a disadvantaged area from being in a disadvantaged family, our study includes data on individuals moving into and moving out of disadvantaged areas.

Patricia M. Sullivan and other researchers recommend that children with disability need to be included and counted in national databases on crime victims, child abuse and neglect, health care, and mental health (P. M. Sullivan, 2009). The present study examines the risk factors preceding the first time a child is subject to a violent crime among total birth cohorts with and without disabilities, according to the Danish national registers. Only reported violent offences against seven-to-eighteen-year-old adolescents are included in this study. Presence of disabilities and types of disabilities are based on medical records, and criminal offences are based on law enforcement records for the total birth cohort of children. Family and community settings, e.g. parental background factors and 'living in a disadvantaged area', are all based on national registers. We have not included information about perpetrators, because only a part of the perpetrators are identified, charged, and convicted. To avoid a biased sample of the victimization, we have based the study on law enforcement records for total birth cohorts of children.

1.1. Theoretical framework

Social-ecological theory posits that violence against children with disabilities should be addressed by investigating the underlying cultural norms and child protection system in the family, the community, and the nation (Bronfenbrenner, 1979; Njelesani, 2019). Children with disabilities are vulnerable due to their stage of development or dependence on caretakers. They face mental, physical, and sexual violence, as well as social exclusion and hate crimes in all settings, including the family, schools, institutions, work settings and in the community at large (FRA, 2015).

There are three notable theoretical focus points within the socio-ecological approach: one that links violent behavior with community characteristics and only to a lesser extent with individual characteristics; the second links poly-victimization with childhood and family adversity as a risk factor for violent victimization; and the third uses the individual's vulnerability to explain differences in exposure to violent behavior. We use these theories about potential causes of violence against children with disabilities to select potential risk factors in our analysis.

Violence against children can be seen as a product of multiple risk factors in the family and in community settings. Offenders and

victims of violence have the most contact with each other in the home, in their neighborhood, or in school (FRA, 2015). According to the first theory that links violent behavior with community characteristics and only to a lesser extent with individual characteristics (Sampson, Morenoff, & Raudenbush, 2005; Wikström 1998), in a highly integrated community, social control is exercised via internalization of societal norms and values. The assumption is that communities with a low degree of integration tend to have a relatively high frequency of violence. Hostile behavior towards children with disabilities, and segregation and isolation of adults and children with disabilities, could be causes of violence against children with disabilities (FRA, 2015). Children with disabilities are at an increased risk because of isolation, stigma, discrimination and economic pressure (Lightfoot, 2014; Stalker & Mcarthur, 2012).

Children with disabilities may be vulnerable to violent abuse because of their dependence on cares, possible isolation from parents and families, and their communicative or intellectual impairments. Parents or others taking care of a child with a disability may be under considerable pressure because of financial and emotional issues in caring for the child (FRA, 2015). The broader society's response to disability, including discrimination, lack of support, and lack of opportunities, could increase the risk of violence (Lightfoot, 2014).

We hypothesize that child-rearing methods, and disadvantages during the formative years can be correlated with later victimization by violence at school age. The second theory posits that childhood and family adversity are risk factors for violent victimization. Examples of family adversity are chaotic and disruptive family events that resulted in loss and separation from important people. Major life events including separation of parents, change of caretakers, change in living conditions, change of residence, and repeating a class during the preceding year are expected to be precursors for increased risk of violent victimization. Lussier and colleagues hypotheses that early life adversities may create a context conducive to victimization (Lussier, Chouinard-thivierge, Mccuish, Nadeau, & Lacerte, 2019).

The third theory focuses on the individual's vulnerability and uses this to explain differences in exposure to violent behavior, in the context of present and future resources and conditions (e.g., lack of education, poverty, alcohol or drug abuse, severe somatic disease, mental illness, ongoing or previous psychiatric treatment, homelessness, incarceration and other types of institutionalization, and long-term unemployment). We hypothesize that children of parents characterized by low socioeconomic status, poverty, and education underachievement are most at risk for being a victim of a violent crime. The school failure leads to negative self-image, dropping out of school, and associating with delinquent-prone peers (Briere, 1996; Larson, 1988; Levin, Zigmond, & Birch, 1985; P. M. Sullivan, 2009). This paradigm posits that income and wealth concentration and structural changes in society leading to unemployment, poverty, and reduced relevance of and opportunities for education are factors beyond the immediate control of the family, although individual parents will often blame themselves for being unemployed, poor, or marginalized.

Our study is a theory-driven and uses data from police records, medical records, and reliable individual, family and administrative records to identify associations and pathways between child disabilities and risk of violent crimes against children. The first theory inspire us to include the variable "living in a disadvantaged area", while the second theory motivate us to include the following variables describing disadvantages during adolescence such as parental suicidal behavior, parental mental retardation, mental illness, parental substance abuse, parental violence, family separation, and parental long-term unemployment. The third theory encourage us to include variables such as individual vulnerability and risk prone behavior e.g. adolescent suicide attempt, drug abuse, alcohol abuse, and convictions of violence. These multiple and changeable risk factors, multiple disabilities, and changeable disability status are accounted for in the analysis. Our method enables us to disentangle characteristics of vulnerability in families, living in disadvantaged areas, and individual vulnerability from characteristics of disability.

2. Methods

2.1. Population

The study population is 678,520 individuals born 1984 to 1995. First-time victims are studied. The eleven national birth cohorts of children born 1984 to 1994 are followed from their 7th until their 18th birthday. Family and community risk factors preceding the first time a child is registered as a victim of violence are included. The study analyzes the characteristics of 23,763 first-time cases of violence against adolescents seven to eighteen years old recorded by the Danish police between 2001 and 2012. In this study, the controls (based on years at risk) were constructed using those individuals in the total birth cohort who had not been a victim of a violent crime during the observation period. The aim was to compare the case-events with the person-years of these controls.

Data records describing victims of a violent crime are only available after 2001 in the Danish archives. Therefore, we only track victims in the window from 2001 to 2012. We have chosen to follow children aged 7 to 18 years old, and this is the reason why we analyze the eleven cohorts born between 1984 and 1994.

2.2. Procedures

Computerized archival data were retrieved from Statistics Denmark (the central authority on Danish statistics). Personal identity numbers were initially used to link information for each individual from birth together with information about their parents. Later, the personal identity numbers were substituted with an encrypted number for security and ethical reasons. In the process, all personal information that could identify the adolescents and their parents were removed from the data.

The risk factors and measures of disability are divided into three types for the purpose of this study. The Type I risk factor are those that are taken to be indicative throughout the risk period. Risk factors of Type II, in contrast, identify the presence of that factor in the previous year. Finally, the Type III risk factors act on the following year and all the subsequent years.

The potentially confounding risk-factors and disability records were collected independently from various population-based registers, e.g. employment statistics, housing statistics, education statistics, income compensation benefits, and population statistics (e.g. gender, age, address). Hospital records with information on types of disability based on the national inpatient register and national psychiatric register were collected independently of the collection of law enforcements records about reported violent offences under the Danish Central Crime Register. Information from the justice system is consistently recorded without compromising the reliability of the records maintained from health department or socioeconomic parameters from national registers.

2.3. Measures of disability

The types of disability are based on a database mandated, compiled and maintained by Danish hospitals in accordance with the international statistical classification of diseases and health-related problems (WHO, 1994). For our analysis, disabilities that may hinder an adolescent's ability to communicate were grouped under speech disability. For example, Cerebral Palsy was grouped under speech disability (i.e. developmental disorders of speech and language).

Disability measures including autism (Autistic Spectrum Disorder), ADHD (Attention-Deficit Hyperactivity Disorder), mental retardation, dyslexia were diagnosed in psychiatric wards in accordance with the Danish Psychiatric Nationwide Case Register. Cases of ADHD are also recorded if a child has received ADHD medication prescribed by medical practitioner. Individuals can have multiple diagnoses. Some of the disabilities are severe, life-long disabilities attributable to mental and/or physical impairments, manifested before 18 years of age (Type I). Examples of this are the autistic spectrum of disorders, ADHD, mental retardation, epilepsy, sensory impairment (e.g. loss of hearing, blindness), Down's syndrome, and other congenital malformations.

Some disabilities are assumed to be acquired (Type III) and are therefore only recorded when found. These include speech disability (e.g. developmental disorders of speech and language, cerebral palsy), brain injury (e.g. mental disorders due to brain damage and dysfunction, post-concussion syndrome, chronic post-traumatic headache), stuttering (e.g. behavioral and emotional disorders with onset usually occurring in childhood and adolescence), dyslexia, and physical disabilities (i.e. orthopedic impairment).

2.4. Measures of violence

According to Article 19 of the Convention on the Rights of the Child (CRC), violence is understood as any form of physical or mental violence, injury, abuse, neglect or negligent treatment, maltreatment, or exploitation, including sexual abuse (CRC,Committee on the Rights of the Child, 2011). In the present study, for practical reasons we have narrowed the definition of violence to a violent crime according to Danish law enforcement records. This includes adolescents who have been victim of a violent personal crime according to the Danish Criminal Code (Jensen, Greve, Høyer, & Spencer, 2003). As such, our definition of violence includes a broad spectrum of conventional violence against the person, including attempted homicide, assault, aggravated assault, battery, robbery, duress, threats, offences against personal liberty, and blackmail. Our definition of violence also includes violation of court orders or police restraining orders. However, the definition of violent crime in this study did not include rape, as rape is categorized as a sexual offence in the national registers. The violent crime data were collected from the police records of reported criminal offences. We have no information whether an alleged perpetrator could be a caregiver, peers or others. A limited number of the alleged perpetrators can be identified with the help of the Danish Central Crime Register, but we have chosen not to include information about the alleged perpetrator in the present study in order to avoid selection bias.

2.5. Measures of risk factors

We selected potential risk factors on the basis of the previously mentioned theories base on research literature in this field. Eighteen variables were identified that could be derived from the registers. The variables are listed in Table 2.1–2.2.

Risk factors such as disadvantage during adolescence (e.g. parental mental illness, suicidal behavior, substance abuse, parental violen;1;ce, family separation, early parenthood, and parental unemployment) are included in the analysis together with information about living in a disadvantaged area or indicator of ethnic minority (e.g. non-Danish citizens). The adolescent's current situation, high-risk behavior, and vulnerability such as suicidal behavior, substance abuse and criminal convictions are included (see Appendix A for exact operationalization).

2.6. Statistical analysis

The data have been analyzed by the discrete time-Cox model (Allison, 1982), where an individual's event history is broken up into a set of discrete time units (a calendar year) in which an event either did or did not occur. An event is first-reported violent crime against the individual. The model allows family vulnerability, living in a disadvantaged area, individual risk factors and disability measures to change during the period under observation. A discrete-time model is more appropriate for the estimation of parameters as it treats each individual history as a set of independent observations. The maximum likelihood estimator can be obtained by treating all the time units for all individuals as though they were independent, when studying first-time events (Allison, 1982).

Each individual is observed until time t, at which point either an event occurs or the observation is censored, by reaching the age limit, because of death, or the individual is lost to observation for other reasons, e.g. emigration. Consequently, individuals were excluded after the first event. Pooling the non-censored years of all individuals, the person-years, made the numbers at risk. The person-years at risk were analyzed for the eleven birth cohorts of children born 1984 to 1994. A dummy variable was included in the

model for each age from 7 to 18 years in order to adjust for age.

We created a dummy for each type of disability and each risk factor for each year. The model allows for discriminating between acquired disabilities and lifelong disabilities. The model also allows for multiple disabilities and we controlled for multiple disabilities in the tests. A procedure was carried out to select significant risk factors to give the best possible prediction. Only first-reported victims of a violent crime were analyzed in the Cox-model. The available event history data contains information on events that fell within each calendar year from 2001 to 2012.

The purpose of the present analysis was to locate relevant risk factors and describe both the strength (odds ratio) of different risk factors, and the overall exposure of risk factors in the population. These two components (strength and exposure) decide the risk factors' contribution to the number of victims, and attributable fractions (AF) are calculated (Greenland, 2008). The AF express the reduction in incidence of reported violence that would be achieved if the population had not been exposed at all, compared with the current exposure pattern (Greenland & Drescher, 1993).

3. Results

Reported violent offences against adolescents are rare. Among all persons aged 7–18 years old in the years 2001–2012, there were 3.5 percent (i.e. 23,763 persons) victims of a reported violent crime among 678,520 persons born 1984–1994. The number of person-years was 4,305,494 for the eleven birth-cohorts active in the window between 2001 and 2012.

The most common disabilities were autistic spectrum disorder (8.8% of person-years), ADHD (10.7% of person-years), mental retardation (7.9% of person-years), and brain injuries (5.6% of person-years). The last item is assumed to be acquired (Type III), while the other disabilities listed are assumed to be life-long disabilities manifested before 18 years of age (Type I).

The bivariate results from the discrete-time Cox analysis showed that nearly all indicators of disability predicted an increased risk of victimization compared to adolescents without disability, except congenital malformations, e.g. Down's syndrome.

Adolescents with ADHD, autistic spectrum disorders, or mental retardation were 2.7 times (odds ratio: 2.7–2.8) more likely to become a victim of violence (see Table 1) than adolescents in the same age group. Adolescents with brain injury, stuttering, dyslexia and blindness were about two times more likely to become a victim of a reported violent crime (odds ratio: 1.8–2.4). Children with speech disability, loss of hearing, epilepsy, and physical disabilities have been found at increased risk of becoming a victim of a violent crime (odds ratio: 1.3–1.4) than that of their peers.

The victims had multiple disabilities. One fourth of the victims suffered from ADHD (24.5%), while 20.2% were diagnosed with autistic spectrum disorder and nearly as many of the victims were mentally retarded (18.6%). About ten percent of the victims suffered from speech disability (i.e. developmental disorders of speech and language). Nearly ten percent of the victims (9.8%) suffered from a brain injury the year or some years before they became a victim of a violent crime.

Our analysis showed that family vulnerability predicted adolescents' risk of becoming a victim of a violent crime, when adjusted for other risk factors and adolescents' disability (see Table 2.1). Family separation predicted an increased level of risk of becoming a victim of a violent crime (odds ratio 1.7; AF 20.1%). Approximately one third of the children in the control years experienced family separation, and these person-years were overrepresented among the victims. The family vulnerability counted for 20.1% of the cases. The adolescents of parents registered with parental suicidal behavior, substance abuse or parental violence (e.g. parent exposed to

Table 1
Indicators of disability.

Factors associated with disability:	Type	% of controls	% of cases	OR	95% CI
Autistic spectrum disorders	(I)	8.8	20.2	2.6	[2.5–2.7]
Speech disability (e.g. cerebral palsy)	(III)	8.2	10.9	1.4	[1.4–1.5]
ADHD	(I)	10.7	24.5	2.7	[2.6–2.8]
Loss of hearing	(I)	1.1	1.5	1.4	[1.2–1.5]
Epilepsy	(I)	1.6	2.1	1.3	[1.2–1.4]
Mental retardation	(I)	7.9	18.6	2.7	[2.6–2.7]
Down's syndrome	(I)	0.1	–	Ns	
Brain injury	(III)	5.6	9.8	1.8	[1.7–1.9]
Stuttering	(III)	2.8	6.1	2.4	[2.2–2.5]
Physical disabilities (i.e. orthopedic impairment)	(III)	1.3	1.7	1.4	[1.2–1.5]
Dyslexia	(III)	1.4	3.1	2.3	[2.1–2.4]
Blindness	(I)	0.06	0.12	2.0	[1.4–2.8]
Congenital malformations	(I)	0.5	0.4	Ns	

Odds ratio for types of disability prior to first-time victim of a violent crime.
Person-years for children born in 1984–1994 (age 7 to 18 years old). Bivariate results from a discrete time Cox analysis.
Note:
Type of time-dependency.
Type I: disability factor observed at time t also covers the years before and after the years under investigation.
Type II: exposed to risk factor at time t then the risk factors is also present at t + 1.
Type III: exposed to disability factor at time t then risk factor is also present at all the following years.
Ns means: non-significant; OR = odds ratio; 95% CI = confidence interval.

Table 2.1
Family vulnerability.

Risk factors:	Type	% of controls	% of cases	OR	95% CI	AF %
Disadvantages during adolescence						
Parental suicidal behavior	(I)	10.3	18.8	1.1	[1.0–1.2]	1.0
Mother mental retardation	(I)	4.8	9.1	Ns		–
Father mental retardation	(I)	3.8	6.3	0.8	[0.8–0.9]	–
Parental inpatient mental illness	(I)	16.8	28.1	Ns		–
Parental substance abuse	(I)	17.2	29.7	1.2	[1.2–1.3]	3.3
Parent diagnosed with ADHD	(I)	8.4	14.8	Ns		–
Parental violence	(III)	13.6	27.3	1.5	[1.4–1.5]	6.4
Child ever in care	(III)	2.0	6.1	1.3	[1.2–1.3]	0.6
Family separation	(III)	35.9	56.4	1.7	[1.7–1.8]	20.1
Mother teenager	(I)	1.9	4.2	1.4	[1.3–1.5]	0.8
Parent unemployed > 21 weeks	(II)	6.9	9.6	1.2	[1.1–1.2]	1.4

Odds ratio for risk factors prior to first-time victim of a violent crime.
Person-years for children born in 1984–1994 (age 7 to 18 years old). Adjusted results from a discrete time Cox analysis. (continued).
Note:
Type of time-dependency.
Type I: risk factor observed at time t also covers the years before and after the years under investigation.
Type II: exposed to risk factor at time t then the risk factors is also present at t + 1.
Type III: exposed to risk factor at time t then risk factor is also present at all the following years.
Ns means: non-significant. AF can only be estimated for odds ratio > 1. OR = odds ratio; 95% CI = confidence interval.
The AF (i.e. attributable fraction) is not calculated because the risk factor is not changeable.

Table 2.2
Individual vulnerability, disadvantaged area and minority.

Risk factors:	Type	% of controls	% of cases	OR	95% CI	AF %
Adolescent is male[1]	(I)	50.9	72.3	2.5	[2.5–2.6]	–
High risk behavior:						
Suicide attempt	(III)	1.9	4.4	Ns		–
Drug abuse	(II)	0.6	1.8	0.9	[0.7–1.0]	–
Alcohol abuse	(II)	0.9	2.7	1.8	[1.6–2.0]	0.7
Convicted of violence	(III)	0.3	0.8	1.5	[1.3–1.8]	0.1
Location or neighborhoods:						
Disadvantaged area	(II)	2.2	3.8	1.4	[1.3–1.6]	0.9
Non-Danish	(II)	8.4	9.9	1.2	[1.1–1.2]	1.7

Odds ratio for risk factors prior to first-time victim of a violent crime.
Person-years for children born in 1984–1994 (age 7 to 18 years old). Adjusted results from a discrete time Cox analysis. (continued).
Note:
Type of time-dependency.
Type I: risk factor observed at time t also covers the years before and after the years under investigation.
Type II: exposed to risk factor at time t then the risk factors is also present at t + 1.
Type III: exposed to risk factor at time t then risk factor is also present at all the following years.
Ns means: non-significant. AF can only be estimated for odds ratio > 1. OR = odds ratio; 95% CI = confidence interval.
[1] The AF (i.e. attributable fraction) is not calculated because the risk factor is not changeable.

violence or parent convicted of violence) had a 10%, 20% or 50% increased risk of becoming a victim of a violent crime, respectively. Parental long-term unemployment the previous year (Type II) indicated an increased risk of becoming a victim of a violent crime of 20% (odds ratio 1.2; AF 1.4%), when adjusted for other risk factors and adolescents' disability status.

Adolescent males had a high risk of being a victim of a violent crime (odds ratio 2.5) compared to females in the same age group when adjusted for other risk factors (see Table 2.2).

The adolescents' individual vulnerability (e.g. alcohol abuse or conviction for violence) indicated an 80% or 50% increased risk of becoming a victim of a violent crime (odds ratio 1.8 and 1.5), respectively. Engagement in violent crime elevated the risk of being a victim of violence. Only few of the person-years were exposed to these disadvantages. Only 0.9% and 0.3% of the person-years were registered for these disadvantages and therefore the attributable fractions were low, AF were 0.7% and 0.1%, respectively.

While living in a disadvantaged area (Type II), adolescents experienced an increased risk of being a victim of a violent crime, but only few person-years (2.2% of control's person-years) were spent in the disadvantaged areas, and only a small proportion of the victims of a violent crime were attributed to the years living in a disadvantaged area (odds ratio 1.4; AF 0.9%).

The indicator of ethnic minority (e.g. non-Danish citizens) increased the risk of being a victim of a violent crime (odds ratio 1.2;

Table 2.3
indicators of Disability.

Risk factors:	Type	% of controls	% of cases	OR	95% CI	AF %
Factors associated with disability:						
Autistic spectrum disorders	(I)	8.8	20.2	1.2	[1.1–1.3]	1.7
Speech disability	(III)	8.2	10.9	0.9	[0.8–0.9]	–
ADHD	(I)	10.7	24.5	1.8	[1.7–1.9]	7.9
Loss of hearing	(I)	1.1	1.5	1.2	[1.1–1.3]	0.2
Epilepsy	(I)	1.6	2.1	Ns		–
Mental retardation	(I)	7.9	18.6	1.2	[1.1–1.3]	1.4
Down's syndrome	(I)	0.1	–	Ns		–
Brain injury	(III)	5.6	9.8	1.3	[1.2–1.4]	1.7
Stuttering	(III)	2.8	6.1	0.7	[0.7–0.7]	–
Physical disabilities (i.e. orthopedic impairment)	(III)	1.3	1.7	1.2	[1.1–1.3]	0.3
Dyslexia	(III)	1.4	3.1	0.9	[0.8–1.0]	–
Blindness	(I)	0.06	0.12	1.6	[1.1–2.4]	0.1
Congenital malformations	(I)	0.5	0.4	Ns		–

Odds ratio for risk factors prior to first-time victim of a violent crime.
Person-years for children born in 1984–1994 (age 7 to 18 years old). Adjusted results from a discrete time Cox analysis.
Note:
Type of time-dependency.
Type I: risk factor observed at time t also covers the years before and after the years under investigation.
Type II: exposed to risk factor at time t then the risk factors is also present at t + 1.
Type III: exposed to risk factor at time t then risk factor is also present at all the following years.
Ns means: non-significant. AF (i.e. attributable fraction) can only be estimated for odds ratio > 1.
OR = odds ratio; 95% CI = confidence interval.

AF 1.7%).

A stepwise logistic regression was performed, which included risk factors if they were significant at the 5% level (see Table 2.1–2.3). In this way, the final model contains a set of risk factors which are all significant. Table 2.3 shows that there are ten indicators of disability that remain statistically significant within the model.

Epilepsy, Down's syndrome and other congenital malformations were excluded because of insignificance. Downs' syndrome and other congenital malformations turned out to be too infrequent to be included in the final model. Loss of hearing and blindness were both infrequent (1.1% and 0.06% of controls, respectively) and therefore evaluated to be uncertain. The odds ratios for speech disability, stuttering, and dyslexia changed from being more than one to being less than one.

Seven of the 13 indicators of disability remain statistically significant with odds ratio > 1. The adjusted odds ratios range from 1.8 for ADHD to 1.2 for autistic spectrum disorder, mental retardation, and physical disability.

Adolescents with autistic spectrum disorder, ADHD, mental retardation, and brain injury were still over-represented among the victims of violent crime (odds ratios were 1.2, 1.8 1.2 and 1.3, respectively), even when adjusted for background risk factors such as family vulnerability, and living in a disadvantaged area or being a member of an ethnic minority group, i.e. non-Danish citizens (see Table 2.3).

When we take into account the number of years adolescents were exposed to these disadvantages, ADHD turned out to contribute to 7.9% of cases of victims of violence, while autistic spectrum, mental retardation, and brain injury contributed to 1.7%, 1.4% and 1.7% of the cases, respectively. Loss of hearing, physical disability and blindness contributed less than 0.3% of the cases.

The bivariate results from the discrete-time Cox model (Table 1) shoved that adolescents with autistic spectrum disorder, ADHD, mental retardation, and brain injury all had an increased risk of being a victim of a violent crime. The unadjusted odds ratios were 2.6, 2.7, 2.7, and 1.8. When we adjust for confounding risk factors and age, risks were reduced (odds ratios were 1.2, 1.8, 1.2, and 1.3, respectively). Location or neighborhoods only contributed with 0.9% of the cases (Table 2.2), while being a non-Danish citizen increased the risk of being a victim of a violent crime (odds ratio 1.2) and contributed to 1.7% of the cases. The indicators of family vulnerability seem to play an important part of the risk of being a victim of a violent crime for adolescents with disabilities (see Table 2.1).

4. Discussion

In accordance with previous studies, we found strong indications that children and youths with some types of disability are at an increased risk of being victims of a reported violent crime during their school years or adolescence. We hope our assessment of risk factors may help professionals to facilitate prevention and treatment interventions, such as psychoeducation of family members, teachers, and school-mates in order to increase understanding of the disability conditions and their potential relation to violent crime. Target groups for measures and initiatives to prevent and protect against violence should include all stakeholders, families and communities, professionals and children with disabilities.

Previous studies of the prevalence and sociodemographic characteristics of children with chronic conditions show that disabilities

are more prevalent among children from low-income families and children from single-parent homes (Fujiura & Yamaki, 2000; Mudrick, 2002; Stein & Silver, 1999). Families receiving public assistance are twice as likely to have a child with a disability as higher income families are (Lee, Sills, & Oh, 2002, P. M. Sullivan, 2009). Our study found that parental substance abuse, parental violence, family separation (single motherhood), teenage motherhood, and living in a disadvantaged area indicate an increased risk of a child becoming a victim of a violent crime(odds ratio: 1.2–1.7) when adjusted for other risk factors and type of disability (see Table 2.1–2.2). The adolescent's own abuse of alcohol, and criminal convictions were associated with an increased risk of being a victim of a violent crime (odds ratio: 1.6–1.9).

According to other victimization surveys, males are more likely to become violent-crime victims than females. Persons with low incomes have a higher risk of becoming crime victims than people who are wealthier (Doerner & Lab, 2015). In our study, we found that males had a higher risk of being a victim of violence (odds ratio: 2.5), when adjusted for other confounding risk factors. Likewise, non-Danish minorities and adolescents living in a disadvantaged area had an increased risk (odds ratio: 1.2–1.4) when adjusted for confounding risk factors, disability type and age.

To disentangle risk factors associated with an increased risk of being a victim of violence from the risk linked to various types of disability, we performed a comprehensive regression analysis including both risk factors and types of disability (Table 2.1–2.3). This showed that children with disabilities were still more likely to be victims of a reported violent crime than non-disabled children: ADHD adjusted odds ratio: 1.9 (1.8–2.0), mental retardation: 1.2 (1.1–1.3), brain injury: 1.3 (1.2–1.4), autism: 1.2 (1.1–1.2), physical disabilities: 1.2 (1.1–1.3). Speech disabilities, stuttering, epilepsy, and dyslexia were not associated with an increased risk of being a victim of violence, when adjusted for confounding risk factors and age (see Table 2.3). The predicative association between disabilities and victimization was reduced when family disadvantages (e.g. parental suicidal behavior, parental substance abuse, parental violence, family separation) and other confounding risk factors were taken into account.

To evaluate the indicator of disadvantage's contribution to the number of victimized children, attributable fractions (AF) were calculated for each risk indicator, in accordance with Greenland and Drescher (1993). The attributable fractions express the reduction in incidence of cases of violence that would be achieved if the population had not been exposed at all compared with the current exposure pattern (Greenland & Drescher, 1993). The relevance of a potential indicator of disability is a combination of the size of incidence in the case group (odds ratio) and the size of the population exposed to the indicator of disability (% of controls).

The attributable fractions tell us that, in the person-years under observation, children with ADHD counted for about 8.6% of the total number of victims of a violent crime, while autism, mental retardation and brain injury counted for 1.7%, 1.5%, and 1.7%, respectively.

Our results provide knowledge on tendencies in the victimization of adolescents with disabilities that could be built into initiatives to combat such victimization. In the following, we briefly discuss other research in the field, and some of the recommended initiatives that our results could inform.

In a survey of various stakeholders in 13 EU Member States, respondents identified the following potential causes of violence against children with disabilities: Overburden of parents and lack of support for parents, overextended and undertrained care personnel, risk factors relating to perpetrators seeing children with disabilities as 'easy targets', lack of knowledge about disability, isolation and segregation from the community, and societal attitudes based on prejudice and fear of 'otherness' (FRA, 2015).

4.1. Suggested policy implication

To create a safer world for children, the UN CRC committee suggests disseminating information regarding a positive approach to child protection through creative public campaigns, schools and peer education, family, community and institutional educational initiatives, professionals and professional groups, NGO's and civil society (P. M. Sullivan, 2009). The committee recommends ten courses of action, including: (1) Awareness raising and educational campaigns; (2) fighting isolation of people and children with disabilities; (3) supporting children with disabilities to protect themselves and their peers through awareness raising on rights; (4) self-empowerment training; and (5) support to children via child helplines. The recommendations continue with measures targeting families and communities include providing e.g. (6) pre- and post-natal services, home visitation programs; (7) quality early-childhood development programs; respite programs and family support centers, shelters and crises centers including (8) training on rights and recognizing abuse. Finally, the committee recommends (9) measures targeting professionals include guidelines, protocols on how to identify signs of ill-treatment and standards of care together with (10) training programs for professionals. The UN CRC Committee notes that administrative measures should reflect governmental obligations to establish policies, programs, monitoring and oversight systems required to protect the child from all forms of violence (CRC,Committee on the Rights of the Child, 2011).

Remembering that in our study, the attributable fractions showed that, in the person-years under observation, children with ADHD counted for about 8.6% of the total number of victims of a violent crime, one could argue that some initiatives should target children with ADHD. The impulsiveness and low self-control associated with children with ADHD could be helped by changing the environments in preschool or schools (Pfiffner, Barkley, & Dupaul, 2006). Potential victims who are risk taking and have low self-control will also be relatively more dependent on their surroundings and conditions in schools and homes compared to persons with a high self-control. Training professionals and parents in autism (psychoeducation) is seen as an example of changing the environment of individuals with autism (Peeters & Gillberg, 1999). These approaches emphasize community-wide prevention strategies, together with a focus on media exerting influence on norms and values, rather than attempting to change the attitudes and predispositions of individuals in high-risk groups. An example is general implementation of anti-bullying programs in schools (from preschool to secondary school).

If such prevention strategies are to be appropriate for forming a general crime prevention strategy, there has to be a causal link

between effective population intervention measures and criminal activities. There have been several comprehensive reviews of such evidence (Farrington & Welsh, 2007). These measures include: changing parenting practices (Olds et al., 1998); changed environments in preschools (Schweinhart et al., 2005); peer tutoring or mentoring in schools (Hahn, 1999; Welsh, 2007); school training programs (Pfiffner et al., 2006); and anti-bullying programs in schools (Olweus, 2005). These measures have demonstrated causality via effective prevention in randomized control trials.

Assessment of risk factors may permit professionals to facilitate prevention and treatment interventions, such as psychoeducation of family members, teachers, and peers in order to increase understanding of the disability conditions.

4.2. Study limitations

Exploring causal effects is the most difficult problem in fields such as the one examined here. In most studies, etiological circumstances are to be found in cross-sectional surveys. The methodology in the present study is an improvement and a step closer to giving information on causes and therefore preventive suggestions. Although prospective longitudinal studies offer the best way to study the predictors of delinquent and criminal behaviour (Murray, Farrington, & Eisner, 2009), this approach is insufficient to establish evidence for a prevention strategy.

Another shortcoming of our design is the nature of the available data in the Danish registry system. Although the amount of data is overwhelming, the surveyed theories open up for risk factors which are only partly or insufficiently represented in the registry system.

We have reason to assume that many of the school children with disabilities do not contact the police or actors in the criminal justice system in response to their victimization because they realize they can minimize their losses by avoiding the legal system (Doerner & Lab, 2015). An effective strategy to combat violence against children with disabilities may be to turn to informal channels such as family and friends, and formal sources of help such as the police, health care professionals, religious leaders, and the social service system. The criminal justice process can be regarded as a sequence of decisions where the victim's complaint could be dropped. In principle, bias against children with disabilities could occur at many stages of the process. Some of the incidences of violence might not be reported to the police, in some cases witnesses may be reluctant to contact the police, and in some incidences the victims might be considered untrustworthy in a court of law, or the victims experience insufficient social support from the community, the authorities and the police. These factors may hinder school children with disabilities in obtaining legal safeguards (FRA, 2015). The present study has probably underreported the size of the problem investigated because adolescents with disabilities face barriers when reporting victimization.

4.3. Conclusion

The results of our study provide empirical insight into the first-time prevalence of victimization among children with disability and the predicative association between family disadvantages and victimization.

We found evidence that adolescents aged 7–18 years old with disabilities are more likely to be exposed to reported violent crimes. Family disadvantages also resulted in a higher risk of reported violent crimes against adolescents. After controlling for confounding risk factors, autistic spectrum disorders, ADHD, mental retardation, and brain injury accounted for most of the cases where first-time violent crimes were reported.

Declaration of Competing Interest

None.

Acknowledgements

I owe many thanks to an anonymous civil servant in the ministry of social affairs who found several errors in a previous manuscript. We thank The National Board of Social Services for generous research support. My colleague, senior researcher Henning Bjerregaard Bach are thanked for his help in analyzing data, while senior researcher Helle Holt are thanked for her critical and helpful comments. I have received helpful comments and useful critics from Esben Meulengracht Flach and Mark Harvey Simpson. I appreciate the thoughtful comments of the three anonymous referees.

The National Board of Social Services has no involvement in the collection, analysis and interpretation of data, nor in the writing of the report, and the decision to submit the article for publication.

Appendix A. The outcome, risk factors and their definitions

Outcome factor:	Definition
Victim of violence	Victimization by a violent crime under the Danish Criminal Code (Jensen et al., 2003). Only criminal complaints to the Danish police about violence e.g. offences against personal liberty, violence against the person, homicide, assault, threats of violence, robbery, but not theft. Violation of a court order or police restraining order.
Risk factor:	

Parental suicidal behavior	Parents' suicide attempts according to the National Patient Register and the Danish Psychiatric Nationwide Case Register, or suicide according to the Causes of Death Register. Intentional self-harm according to hospital admissions is also included.
Parental substance abuse	Alcohol abuse or drug abuse (see below)
Parental alcohol abuse	According to hospital admissions the following diagnoses were expected to be associated with long-term alcohol abuse: Alcoholic psychosis, alcoholism, oesophageal varices, cirrhosis of liver (alcoholic), chronic pancreatitis (alcoholic), delirium, accidental poisoning by alcohol. Mental and behavior disorder due to use of alcohol also included
Parental drug abuse	Addiction or poisoning by drugs according to hospitals admissions. Mental and behavioral disorder due to use of drugs (e.g. opioids, cannabinoids, cocaine). Dependence on morphine was not included if associated with diseases of chronic pain
Parental inpatient mental illness	One or both parents admitted to a psychiatric ward according to the Danish Psychiatric Nationwide Case Register
Parent diagnosed with ADHD	Diagnosed with ADHD in a psychiatric ward according to the Danish Psychiatric Nationwide Case Register.
Parental violence	Battered adults according to hospitals admissions. Parent exposed to assault or injuries of undetermined intent. Victims of violence which led to hospitalization and professional assessment that the injury was willfully inflicted by other persons. *Parent convicted for violence:* The Criminal Statistic Register records persons convicted for violence. This category comprises a wide range of criminal behavior of various degrees of seriousness: manslaughter, grievous bodily harm, violence, coercion and threats. This category does not include accidental manslaughter in combination with traffic accidents, or rape, which belongs to the category of sexual offences.
Child abuse or neglect	The young person having ever been a victim of violence, abuse or neglect which led to hospitalization and professional assessment of the injury being willfully inflicted by other persons
Child ever in care	The child is living with the parents under caseworker supervision according to the children's acts section, or the child is placed outside the home living in an institution or in a foster home. Information from the population-based register of social assistance to children in care
Family separation	Information on all children who had experienced divorce, separation and or the death of a parent before they were 18 years old, taken from the Danish Central Population Register (CPR) that connects children to their parents whether they are married or not.
Mother teenager	The mother had been a teenager herself when she gave birth to the child in focus.
Parental unemployed > 21 weeks	Unemployment for at least one parent: The number of days unemployed (more than 21 weeks) during a calendar year. From registers of Income Compensation Benefits, Labour Market Research, and Unemployment Statistics. Parental unemployment for one or both parents.
Severe somatic handicap	Adolescents and young adults who had been hospitalized within the observation period for a severe handicap or chronic disease, other than mental handicap and psychiatric disease. Diagnoses included severe diseases of a chronic nature from all organ systems. Examples could be cancers, inborn errors, birth defects, cerebral palsy, and long-lasting damage after head injuries necessitating hospitalization, epilepsy and sequelae after meningitis.
Not graduated from high school	Passed basic, but had not gone on from school to university, not at least graduated, or ever been in high school (gymnasium)
Vocational qualification	Whether the person has a vocational or professional training (e.g. bricklayer, carpenter, dentist, lawyer, or teacher in a kinder garden). This does not include semi-skilled workers. Information is based on Education Statistics or the educational classification database which is population-based, including schooling and educational training for the highest education achieved by the person each parent in focus.
Drug abuse	Addiction or poisoning by drugs according to hospitals admissions. Mental and behavioral disorder due to use of drugs (e.g. opioids, cannabinoids, cocaine). Dependence on morphine was not included if associated with diseases of chronic pain
Psychiatric disorder	Admitted to a psychiatric ward according to the Danish Psychiatric Nationwide Case Register.
Disabilities:	
Autistic spectrum disorder	Autism F84 Pervasive developmental disorders
Speech disability	Specific developmental disorders of speech and language ICD-10:F80, Infantile cerebral palsy ICD-10: G80, Speech disturbances ICD-10:R47, Lack of expected normal physiological development ICD-10:R62
ADHD	Diagnosed with ADHD in a psychiatric ward according to the Danish Psychiatric Nationwide Case Register. ADHD F90 Hyperkinetic disorders and/or receiving ADHD-drugs 'N06BA04' or 'N06BA09'
Loss of hearing	Conductive and sensorineural hearing loss ICD-10:H90-H91, Other disorders of ear ICD-10:H93-95
Epilepsy	Acquired aphasia with epilepsy ICD-10:F80.3, Epilepsy ICD-10:G40
Mental retardation	Mental retardation ICD-10:F70-F79
Down's syndrome	Chromosomal abnormalities not elsewhere classified: ICD-10: Q90
Brain injury	Intracranial injury S06, Other mental disorders due to brain damage and dysfunction and to physical disease F06, Post-concussion syndrome ICD-10: F07.2, Chronic post-traumatic headache ICD-10: G44.3
Stuttering	Stuttering and other behavioral and emotional disorders with onset usually occurring in childhood and adolescence ICD-10:F98
Physical disabilities	Symptoms and signs involving the nervous and musculoskeletal systems ICD-10:R25-R29, Injuries of neck and trunk, limp, ICD-10:T91-T94
Dyslexia	Specific developmental disorders of scholastic skills ICD-10:F81. Dyslexia and other dysfunctions, not elsewhere classified ICD-10:R47
Blindness	Low vision ICD-10:H54
Congenital malformations	Congenital malformations, deformations and chromosomal abnormalities ICD-10:Q00-99
Risk factors:	
Suicide attempt	Self-inflicted harm according to hospitals admissions. The definition of suicide attempts also included behavior that conformed to the following conditions: (i) Suicide attempts that had led to hospitalization, (ii) assessment of the trauma being an act of self-mutilation according to the international statistical classification of injuries when discharged from hospital, (iii) the trauma had to be included in a specified list of traumas traditionally connected with suicide attempts: cutting in wrist (carpus), firearm wounds, hanging, self-poisoning with drugs, pesticide, cleaning fluids, alcohol or carbon monoxide. This does not include non-suicidal self-harm
Alcohol abuse	According to hospital admissions the following diagnoses were expected to be associated with long-term alcohol abuse: Alcoholic psychosis, alcoholism, oesophageal varices, cirrhosis of liver (alcoholic), chronic pancreatitis (alcoholic), delirium, accidental poisoning by alcohol. Mental and behavior disorder due to use of alcohol also included
Convicted of violence	Persons who have been confined with violent personal crimes under the Danish Penalty Code (Jensen et al., 2003) e.g. offences against personal liberty, violence against the person, homicide, assault, robbery, but not theft.
Location or neighborhoods of victim/offender:	
Disadvantaged Area	A governmental board has identified the most disadvantaged housing areas. These are a part of the subsidized housing sector, consisting of 135 areas. About 4% of the population (200,000 persons) lives in these areas. Each area has 1500 inhabitants, on

	average, ranging from. 30 to 14,000 persons. These disadvantaged housing areas were divided into quintiles and the two most disadvantaged quintiles were identified as disadvantaged areas in the present by this dichotomized variable. These most disadvantaged areas would thus cover about 80,000 inhabitants or 1.6% of the total population.
Rented housing	The house or flat is rented, not owned by family
Danish/non-Danish Citizenship	The definition is based on fulfilling one of the following conditions: If at least one of the parents has Danish citizenship and is born in Denmark. If there is no information in the registers about any of the parents and the child himself/herself has Danish citizenship and is born in Denmark. All others are defined as non-Danish.

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