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**Working Paper**

## The effects of bullying in elementary school

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## **ABSTRACT**

### **The Effects of Bullying in Elementary School<sup>\*</sup>**

Bullying is a widespread social phenomenon. We show that both children who are being bullied *and* children who bully suffer in terms of long-term outcomes. We rely on rich survey and register-based data for children born in a region of Denmark during 1990-1992, which allows us to carefully consider possible confounders. Evidence from a number of identification strategies suggests that the relationship is causal. Besides the direct effect bullying may have on the child in the longer run, we show that an additional mechanism can arise through teacher perceptions of short-run abilities and behavior.

JEL Classification: L14, I21

Keywords: victimization, perpetrator, crime, education, health, mental health

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*“IF there’s one goal of this conference, it’s to dispel the myth that bullying is just a harmless rite of passage or an inevitable part of growing up. It’s not. Bullying can have destructive consequences for our young people. And it’s not something we have to accept.”*

- President, Barack Obama at the Anti-Bullying Conference in the White House, March 10, 2011.

## **I. Introduction**

A student is characterized as being bullied or victimized when he or she is exposed, repeatedly and over time, to negative actions on the part of one or more other students (Olweus, 1993). This paper investigates the effects of bullying in elementary school on victims’ and perpetrators’ education, health and risky behavior.

Bullying is a serious and widespread phenomenon: 20 % of the Danish children that we analyze are reported by their parents and/or teacher to be victims of bullying (similar numbers are reported by e.g. Brown and Taylor (2008) for Britain and Nordhagen et al. (2005) for Denmark). From an economic point of view, such common negative actions may be extremely costly, not only in terms of immediate individual welfare but also in terms of longer run consequences. Despite this, very little research documents the impact of bullying on economic outcomes. An exception is the paper by Brown and Taylor (2008) that uses regression based techniques to show that bullying is associated with reduced educational attainment and wages.<sup>1</sup> But not only are victims potentially affected, also the bully himself may suffer. Le et al. (2005) is a rare study that uses twins to identify the negative effects of being a bully, among other conduct disorders, on schooling and labor market outcomes. We

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<sup>1</sup> Their estimates may not be given a causal interpretation because they include a long range of contemporaneous and post-treatment control variables measuring educational attainment, school quality and family background.

know of no other papers studying the link between bullying and long term economic outcomes.

Our paper contributes to this very small literature by using survey and register-based data on children born in a region of Denmark during 1990-1992 to investigate the effects of being bullied at age 10-12 on education, health and crime. We consider longer-term outcomes of intrinsic importance such as 9<sup>th</sup> grade test scores, high school enrolment, crime conviction, teenage pregnancy, psychopharmacological medication, IQ and weight.

To circumvent the problem of non-random selection of victims and perpetrators we exploit access to very rich data, informative both about bullying and outcomes, and incorporate a number of identification strategies and robustness checks in order to come closer to identifying the impact of such experiences than previous research. We first exploit mother fixed effects. Second, we incorporate classroom and school fixed effects. Third, we account for detailed measures of ability and behavior measured just prior to exposure to bullying. For a subset of the children in our sample we also have access to this type of information measured at age 3.5. Fourth, we follow Altonji, Elder, and Taber (2005) and use selection on observable variables to assess the likelihood that our estimates are driven by selection on unobservables. Finally, we perform a falsification test using adult height as outcome, in the spirit of Havnes and Mogstad (2011). We believe that the uniformity of the results across this range of strategies provides strong, if not completely conclusive, evidence that we are uncovering a causal effect.

The survey data present a unique opportunity to define bullying status as both the teacher and parents answered whether the child was a bully or a victim of bullying. Because we are interested in school bullying, the teacher's perception is crucial in order to obtain a truthful picture of the interactions among peers. At the same time it would not be sufficient to restrict

ourselves to the teachers' responses as they do not observe the child for the entire school day, and they do not to the same extent as the child's parents have the confidence of the child.

We identify a strong negative effect of being bullied *and* of being a bully. In particular, we find that both being bullied and being a bully lower 9<sup>th</sup> grade GPA with 20 % of a standard deviation. Being a victim of bullying also increases future use of psychopharmacological medication, body weight (boys) and the probability of teenage pregnancy (girls), while being a perpetrator leads to a higher probability of future criminal convictions. Results are robust to the inclusion of mother, school and classroom fixed effects and to controlling for measures of prior ability and behavior. We find that selection on unobservables should be high for the effects to be completely attributable to unobservables. We study the "effect" on adult height as a falsification exercise because adult height is determined genetically and by early-life events, and find no "effect" whatsoever.

We next investigate a possible mechanism that may drive long-term effects. We show that the teachers' evaluations of bullied children and bullies are immediately affected: teachers perceive bullied children to be particularly weak in terms of academic skills, to have worse mood, and worse social competencies. In addition, both bullied children and bullies are considered to have worse behavior than controls. To the extent that this affects teachers confidence and willingness to invest in victims and bullies, this may easily have consequences in the longer run.

The remainder of the paper unfolds as follows: Section II surveys the literature on bullying and its determinants and consequences. Section III discusses the institutional context and the available data while Section IV presents baseline OLS regressions and Section V our identification strategies and associated results. Section VI investigates teacher perceptions as a potential causal mechanism, and Section VII concludes.

## **II. Background**

As discussed above, bullying is the exposure to repeated negative actions over time on the part of one or more students; Olweus (1993, 1997). Negative actions are intentional attempts to injure or cause discomfort in others. Examples are physical contact, verbal insults, rumors, and intentional exclusion. For the actions to qualify as bullying, an asymmetric power relationship between the bully and the victim should also exist such that the bullied child has difficulties defending him or herself against the perpetrator. The seminal works by Olweus (1993, 1997) describe two victim types: passive and provocative. The typical passive victim is cautious, sensitive and quiet and reacts by crying. Boys who are bullied are generally physically weaker than other boys. The provocative victim, on the other hand, has problems with concentration, causes irritation and tension and is often hyperactive. Olweus (1997) describes bullies as aggressive towards peers, parents and teachers. Bullies are more prone to use violence, are impulsive and have a strong need to dominate others. Furthermore, they are in general physically stronger than other boys.

### ***A. Why Would Bullying Affect Future Outcomes?***

Psychological explanations why bullying affects future outcomes distinguish between the effects of being a victim and being a perpetrator of bullying. Victimization is closely related to harassment and violence (Patchin and Hinduja, 2011), which are known to have unfortunate long-run consequences, although causal relationships are inherently difficult to establish (Currie and Tekin, 2012). The negative long-run consequences may be interpreted in the framework of general strain theory (Agnew, 1992), which argues that individuals who experience a strain (e.g. bullying) may produce negative emotions such as anger, frustration, depression or anxiety which may lead to a corrective action in terms of wrongdoing, self-harm, suicide etc. Ouellet-Morin et al. (2011) show that bullied children had lower and longer



lasting cortisol response to stress than the comparison group, and therefore this is an example of a study suggesting that bullying invoke biological changes in victims with potential long-lasting impacts.

It is less obvious why being the perpetrator of bullying may be associated with unfavorable future outcomes. However, at least two psychological theories constitute a framework for thinking about this relationship. The general strain theory mentioned above suggests that engaging in bullying may be a coping strategy – alongside other deviant behaviors - after experiencing strain (see Patchin and Hinduja, 2011). Thus, being a bully would not necessarily have an impact on future outcomes when strains are sufficiently accounted for.

An alternative theory of bullying is the developmental psychological perspective on antisocial behavior (Patterson, Reid and Dishion, 1992). They argue that antisocial behavior manifests itself in early childhood, and that the child behavior at one stage leads to predictable reactions from the environment in the subsequent stage: poor parental discipline leads to child conduct problems, which leads to peer rejection and academic failure, which again attracts the individual to deviant peer groups. Thus, a child may be withheld in a negative behavioral spiral if antisocial behavior is not met with appropriate adult reaction early in life.

In contrast to the psychological studies, which focus on strains and troublesome home environments as explanations for bullying, sociological studies allow for a fundamentally different interpretation. Faris and Felmlee (2011) interpret bullying in a social network perspective. Bullying is thus one type of aggression, which is associated with attaining and maintaining peer group status rather than a maladjusted reaction for the socially marginal individual. They argue that individuals at the very bottom of the social hierarchy lack capacity to bully, while individuals at the very top of the hierarchy have no reason to bully. If the purpose of bullying is to achieve a higher social status, future economic outcomes may be

affected positively or negatively, depending on the prescribed behavior across the social ladder (Akerlof and Kranton, 2002).

The mentioned theories may be reconciled with the economic theories of life-cycle skill formation (e.g. Heckman, 2008). In economics, it has been shown that early investments not only have a large potential pay-off, they are also efficient in the sense that an equity-efficiency trade-off does not exist, which is the case for later investments. The reasons are that skills acquired in one period persist into future periods and that skills produced at one stage raise the productivity of investment at subsequent stages. Importantly, skills are multidimensional and are likely to complement each other.

In this context, coping with victimization of bullying early in life directs resources away from investment in other skills, while engaging in bullying and other antisocial activities directs resources towards counterproductive skill investments. In addition, to the extent that bullying exerts a direct negative impact on self-esteem and other non-cognitive skills as suggested above, educational and labor market success are also affected through this channel (Heckman (2008) and Waddell (2006)). The loss in terms of education, health and lifetime earnings potential may be enormous if bullying is interpreted in this framework.

### ***B. Prior Evidence about Childhood Bullying***

In this section we review the literature on predictors of being bullied and being a bully in order to obtain a guideline as to defining the conditioning set in our study of the effect of victimization and bullying on educational, health and criminal outcomes.

Brown and Taylor (2008) is one of the few existing studies that actually investigate the link between bullying and educational attainment and wages. They find that strong predictors of being bullied at age 11 are being a boy, having disabilities, unattractive physical appearance, personality traits, and number of schools attended. All of these characteristics as well as

fighting at age seven and financial problems in the family are also associated with being a bully.

Henningsen (2009) identifies the two main determinants of victimization as low family income and not feeling safe with one's parents. However, also parental education and divorce as well as more rare instances such as serious illness in the family, accidents, foster care, drug abuse and sexual assault correlates with victimization. Wolke et al. (2001) confirm that low socio-economic status correlates with both victimization and bullying, and moreover find that ethnic background/skin color is associated with victimization.

A plausible hypothesis is that not only individual characteristics but also the institutional framework matters for the prevalence of bullying. However, Persson and Svensson (2010) find no effects of class-size on victimization. Obviously, school-based anti-bullying programs might also influence the prevalence of bullying. Farrington and Ttofi (2009) systematically review evaluations of such programs and find that long, high-intensity interventions that, among other things, emphasizes teacher and parent training effectively reduce bullying and victimization.

Based on the literature reviewed, the conditioning set in our study of the effect of victimization and bullying on educational, health and criminal outcomes should preferably include socio-economic variables such as gender, age, ethnic origin, family resources and strains, as well as individual characteristics such as personality traits, disabilities, physical appearance, and physical weakness/strength. Among institutional characteristics, the previous literature indicates that class size is of less importance, while school and teacher characteristics or fixed effects should be included to account for anti-bullying prevention and related policies.

### **III. Institutional Context and Data**

This section presents the institutional context within which we perform our analyses and gives a detailed discussion of data sources along with measures of bullying, the set of outcomes, and the conditioning set.

#### ***A. Elementary School in Denmark***

The vast majority of Danish children attend public elementary school (87 %)<sup>2</sup> and subsequently publicly subsidized after-school care (83 %).<sup>3</sup> After-school care most often takes place at an after-school club set up at schools with the idea that children have an integrated day (93 %). The personnel may to a minor extent overlap with the personnel during the school day. However, after-school care may also take place at a recreation centre detached from schools (7 %).<sup>4</sup> Thus school and after-school care is by far the most important scene for social interactions between children.

In grade 0, pupils are taught by a form teacher who is a trained pedagogue. From grade 1 to grade 9, pupils are taught by subject-specific teachers rather than form teachers, among which one or two teachers take on the responsibility as a class teacher. Concern for the social climate in class is the responsibility of the class teacher(s), while introduction of anti bullying programs are most often school-based policies.

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<sup>2</sup> This number includes the pupils attending the voluntary 10<sup>th</sup> grade. For details, see Ministry of Education (2009).

<sup>3</sup> The figures for after-school care apply for 6-9 year-olds. See Statistics Denmark (2010).

<sup>4</sup> The reported figures apply for 6-9 year-olds. Among 10-13 year-olds, 32% attend after-school care, and for this age group it most often takes place in a recreation centre or in a youth club. See Statistics Denmark (2010).

## ***B. Data***

The main data used in the analyses below stem from The Aarhus Birth Cohort (ABC). The data consist of initially 10,907 children born by 10,375 mothers in Aarhus, Denmark during 1990-1992. Of these, 525 women gave birth to more than one child during the period of observation. As indicated, we exploit these sibling-pairs in our formal analysis below. All pregnant women were eligible to participate in the survey and were recruited via tax-paid antenatal health services in their 14<sup>th</sup> gestational week,<sup>5</sup> and 98% chose to participate. In 2001 (when the children were 9-11 years old) and again in 2002, the parents of the children were surveyed and in 2002 also the teachers of the children were interviewed and asked to evaluate the children's behavior and scholastic performance. Another particularly important feature of the teacher survey is that it allows us to link children to teachers and schools. What is crucial for our purposes is that information about teacher and parent assessed incidents of bullying were provided. For part of the children in the survey we also have access to early measures of strengths and difficulties, which we use for robustness checks.

The survey data are augmented with a rich set of register-based information on 1) parents' socio-economic background, crime and health status (level of education, labor market history, settlement patterns, income, prescription drug usage, somatic and psychiatric diagnoses from general hospitals, crime record)<sup>6</sup> and 2) children's early health outcomes including information about circumstances pertaining to the birth of the child, daily information on prescription drug usage, yearly information about hospital use and related diagnoses, type of

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<sup>5</sup> 99.8% of all pregnant women received this type of care. See Delvaux, Buekens, Godin and Boutsen (2001).

<sup>6</sup> The psychiatric diagnoses are obtained from the Danish Psychiatric Central Register; see Munk-Jorgensen and Mortensen (1997) for details.

child care, 9<sup>th</sup> grade test scores, educational event histories, crime record as well as measures on IQ, weight and height from the military service test (for 18-year old boys). We use the register data to strengthen our conditioning set and to construct outcome measures as detailed below.

## **Bullying**

In identifying bullying, we exploit the parent and teacher questionnaires conducted in 2002. Each supplies a rating of the extent to which the child is a victim of bullying and whether the child bullies other children.<sup>7,8</sup>

According to Olweus (1997), negative acts only qualify as bullying if they take place *repeatedly, over time*, and if the negative acts are *intentional* and the victim cannot defend him or herself (*asymmetric power relationship*). In the past decade bullying has received increasing attention in the Danish society. Bullying policies have been introduced in school, the media has drawn attention to the problem at several occasions and politicians have also increased focus on the matter. We therefore assume that the respondents have an appropriate

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<sup>7</sup> Parents and teachers are asked to what extent during the past 6 months: (1) has the child gotten into fights or bullied other children? (2) has the child been bullied or teased by other children in school? (No, To some extent, To a large extent).

<sup>8</sup> Unfortunately, as is common in surveys, not all parents and teachers report. This has consequences both for the measuring of bullying and for some of the mechanisms. Appendix A discusses attrition at length.

understanding of the concept.<sup>9</sup> Of course, we cannot be absolutely certain that the respondents employ the exact same definition as suggested by Olweus.

We identify a child as a victim of bullying if *either* the teacher *or* the parents replied that the child is being bullied “to some extent” or “to a large extent”. In a similar fashion we identify the child as a bully if either the teacher or the parents responds that the child is bullying others “to some extent” or “to a large extent”. We first consider a simple indicator for exposure to bullying. As indicated by the literature, it may, however, be important to distinguish bullies from children who are neither being bullied nor involved in bullying others. Insofar that being a perpetrator of bullying has a negative effect on future outcomes, ignoring this information will downward bias the performance-level of the children in the control group. We therefore split our sample according to whether the parents or teacher reported children as victims of bullying, bully-victims, bullies, or neither of the three. Victims are the children reported by their parents or their teacher to being bullied but at the same time not reported to bully others. Bullies refer to those children who bully others and are not reported to be bullied themselves. Children who are being bullied as well as bully others are labeled bully-victim. Those children who are neither being bullied nor engage in bullying others are denoted the control group.

Presumably, teachers and parents possess different sets of information about the child and the child’s behavior. Thus, we expect that exploiting both reporting sources will provide a more truthful picture of the extent of bullying. Although Oliver and Candappa (2003) find that the majority of pupils would tell their mothers about the bullying episodes, we cannot rule out that some pupils will choose not to inform their parents because they are afraid that this will

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<sup>9</sup> See the discussion by Wolke et al. (2001) about the problems of defining an internationally comparable measure of the prevalence of bullying when the languages differ.

lead the parents to take action which might increase victimization. Similarly, because bullying others is plausibly considered a negative act, the child will possibly be reluctant to tell his parents that he bullies another child. And even if the parents know, they may still have a tendency to underreport whether their child bullies others. Having access to teacher reports, we believe, will reduce such problems. The correlation between the teacher's and parent's responses to whether the child is being bullied is 0.37, while the correlation between their responses to whether the child is a bully is 0.31. The share of children reported to be victims of bullying is almost the same regardless of the type of respondent; 15 % are reported to be bullied by parents and 13 % are reported to be bullied by teachers). The same is not true for perpetrators of bullying; 5 % are reported by their parents to be bullies, while 15 % are reported to be bullies by their teachers, emphasizing the importance of having both information sources. If victimized children and bullies are negatively selected, we expect misclassification due to underreporting to cause a downwards bias in our formal analysis of consequences of bullying.

Table 1 displays the bullying status of the children in our sample. About 20 % of the children are identified as victims of bullying. This resembles the prevalence rates obtained in other studies based on self-reporting or parental reporting (see the introduction). When we further subdivide our sample according to whether children also engage in bullying others, we see that around 6 per cent of the victims are also perpetrators of bullying and 8 per cent of the children in the control group are perpetrators of bullying.

**Table 1** *Bullying Status*

	<b>Victim</b>	<b>Bully-Victim</b>	<b>Bully</b>	<b>Control</b>
Simple bullying definition:	19.6 %	-	-	80.3 %
Refined bullying definition:	13.2 %	6.4 %	7.5 %	72.9 %



## Outcomes

We consider a range of different outcome measures characterizing the child's education, health and risky behavior. The outcomes are obtained from Danish register data and based on information from 2003-2010. A particular advantage of this study compared to other studies using surveys is that we obtain our outcomes from a different data source than our treatment variable, removing concern about common variance. Furthermore because the register information is available for the population of children born in Denmark, we do not face the problem of missing values in our outcome variables due to non-response.

The *outcome measures* are: 1) 9<sup>th</sup> grade GPA, 2) high school enrollment before 2011, 3) whether convicted for any crime, 4) whether the individual has had a teenage pregnancy (girls only), 5) whether any psychopharmacological medication has been prescribed, 6) IQ, and 7) body weight as measured in the military service test at age 18 (boys only).

The child's academic achievement is measured by the marks at the end of 9<sup>th</sup> grade in the subjects written and oral Danish, and written Mathematics. The average is taken over the preliminary mark (given by the teacher based on the pupil's effort and achievement throughout the school year) and the mark at the national school exit exam (written and oral exams that are comparable across schools).<sup>10</sup> To be able to compare grades across cohorts, we standardize grades to zero mean and unit standard deviation within each cohort.

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<sup>10</sup> The written exams are identical across the country and all exams, whether written or oral, are graded by the teacher and an external examiner, where the opinion of the external examiner dominates the opinion of the teacher. 92 % of the children sit the 9<sup>th</sup> grade exam. We ignore the selection into taking the exam.

**Table 2 Means of Outcomes by Bullying Status**

	# obs	Simple bullying definition		Refined bullying definition			
		Victims	Controls	Victims	Bullies	Bully-Victims	Controls
		Mean	Mean	Mean	Mean	Mean	Mean
		Std. Dev.	Std. Dev.	Std. Dev.	Std. Dev.	Std. Dev.	Std. Dev.
<i>9th grade GPA</i>	10,033	<b>0.013</b>	0.350	<b>0.118</b>	<b>-0.031</b>	<b>-0.212</b>	0.388
		0.806	0.732	0.801	0.791	0.772	0.715
<i>High school Enrollment (0/1)</i>	10,907	<b>0.550</b>	0.759	<b>0.604</b>	<b>0.560</b>	<b>0.442</b>	0.780
		0.498	0.428	0.489	0.497	0.497	0.414
<i>Criminal conviction (0/1)</i>	10,907	<b>0.127</b>	0.098	0.090	<b>0.236</b>	<b>0.202</b>	0.084
		0.333	0.297	0.286	0.425	0.402	0.277
<i>Teenage Pregnancy (0/1)</i>	5,309	<b>0.113</b>	0.054	<b>0.094</b>	<b>0.101</b>	<b>0.152</b>	0.051
		0.317	0.226	0.292	0.303	0.360	0.221
<i>Psychopharmacological Medication (0/1)</i>	10,907	<b>0.150</b>	0.094	<b>0.150</b>	0.096	<b>0.150</b>	0.094
		0.357	0.292	0.357	0.295	0.358	0.291
<i>IQ - Military Service Test</i>	4,025	<b>43.213</b>	45.078	44.977	<b>41.308</b>	<b>40.695</b>	45.641
		10.136	8.551	9.934	8.877	9.909	8.359
<i>Weight (kg) - Military Service Test</i>	4,057	<b>78.779</b>	75.692	<b>79.397</b>	75.685	<b>77.902</b>	75.693
		15.831	13.246	16.071	12.837	15.479	13.308

Means are tested against the mean of the control Group. Significant differences are indicated by the font of the numbers.

Bold: 5%-level; italic: 10%-level.

Table 2 shows mean outcomes across bullying status. Victims of bullying have significantly worse outcomes than non-victims. When we consider the refined bullying definition, we see that victims of bullying have significantly worse outcomes than the controls, but perpetrators of bullying have even worse outcomes. For all outcomes but criminal convictions, the raw means indicate worse outcomes for bully-victims compared to pure bullies. About 80 % percent of the controls entered high school compared to about 60 % of the victims and the bullies and only 44 % of the bully-victims. Similarly girls who are perpetrators and/or victims of bullying also to a greater extent engage in teenage pregnancy (10-15% vs. 5%).

The descriptive statistics presented in Table 2 indicate that being a victim of bullying correlates negatively with most future outcomes. Furthermore, it seems important to distinguish between being a bully, a bully-victim and a victim as these groups differ substantially with regards to outcomes which may be due to their bullying status. We stress that these observations do not represent causal pathways.

## Characteristics of Children and Parents

Means of selected characteristics of children and their parents by bullying status are shown in Tables 3A, 3B and 3C. Table B1 in Appendix B describes the full set variables and their source in detail. These variables also serve as our conditioning set in the formal analyses below. Except for height and minor physical handicaps at ages 9-11 which are plausibly unaffected by bullying, all child and parental characteristics are measured before the child turns seven years of age. Girls are more likely to be victims of bullying whereas bullies and bully-victims are more often boys. As suggested by the literature, measures of the quality of family environment such as number of older siblings and parental divorce before the child turns seven years old is predictive of exposure to conflict as is immigrant status. Similarly, poor early mental health indicated by prescription of antidepressives and a mental or behavioral diagnosis established before the age of seven predict bullying status at ages 10-12<sup>11</sup> as does a higher than average number of early emergency ward visits that may be indicative of hyperactive behavior; see Dalsgaard, Nielsen and Simonsen (2012). Physical appearance has also been suggested as a driver of victimization. In line with this hypothesis, we see that minor physical handicaps such as impaired hearing, the wearing of glasses, and cross-eyedness are associated with bullying status. Being enrolled in private (most often specialized) care also correlates with exposure to bullying.

Parents of victimized children are negatively selected in terms of observable characteristics: they are younger when they give birth, they have lower levels of education, lower income, are more likely to be unemployed, more likely to be part-time employed and are less likely to be

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<sup>11</sup> See Currie and Stabile (2006) and Fletcher and Wolfe (2008) who argue that children with ADHD suffer in terms of academic outcomes.

higher level employees. Similarly, they are more likely to be treated for cardiovascular diseases, receive anti-depressives and to have a mental health diagnosis.

**Table 3A Means of Selected Child Characteristics by Bullying Status<sup>a,b</sup>**

	# obs	Simple bullying definition		Refined bullying definition			
		Victims	Controls	Victims	Bullies	Bully-Victims	Controls
		Mean	Mean	Mean	Mean	Mean	Mean
		Std. Dev.	Std. Dev.	Std. Dev.	Std. Dev.	Std. Dev.	Std. Dev.
Boy (0/1)	10,907	0.523	0.503	<i>0.448</i>	<b>0.750</b>	<b>0.675</b>	0.478
Height (cm)	6,687	0.500	0.500	0.498	0.433	0.469	0.500
		8.826	8.193	8.816	8.251	8.848	8.184
Born prematurely (before week 37)	10,801	0.106	0.093	0.095	<i>0.117</i>	<b>0.128</b>	0.091
Birth weight (g)	10,875	0.308	0.291	0.294	0.322	0.335	0.287
		3482	3494	3489	<b>3442</b>	3468	3499
Complications at birth (0/1)	10,807	0.581	0.566	0.570	0.556	0.603	0.566
		0.012	0.011	0.012	0.009	0.010	0.012
# younger siblings	10,825	0.107	0.106	0.110	0.096	0.101	0.107
		0.615	0.645	0.608	0.615	0.630	0.648
# older siblings	10,825	0.694	0.675	0.687	0.679	0.708	0.674
		<b>0.968</b>	0.854	<b>0.915</b>	<b>1.031</b>	<b>1.075</b>	0.836
Ethnic (0/1)	10,845	1.111	0.996	1.059	1.180	1.203	0.973
		<b>0.044</b>	0.023	0.030	0.034	<b>0.072</b>	0.022
Divorce (0/1)	10,906	0.205	0.151	0.170	0.183	0.259	0.147
		<b>0.131</b>	0.088	<b>0.109</b>	<b>0.138</b>	<b>0.175</b>	0.083
# moves	10,906	0.337	0.283	0.312	0.345	0.380	0.276
		0.294	0.293	0.287	0.304	0.307	0.292
Antidepressant medicine (0/1)	10,907	0.609	0.589	0.558	0.592	0.702	0.589
		<b>0.019</b>	0.010	<b>0.022</b>	0.014	0.012	0.010
Diagnosis of mental or behavioral disorder (0/1)	10,907	0.137	0.101	0.148	0.120	0.111	0.099
		<b>0.016</b>	0.005	<i>0.011</i>	0.005	<b>0.027</b>	0.005
Emergency Ward visits from 4-6 yrs. (0/1)	10,907	0.127	0.071	0.105	0.074	0.162	0.071
		<b>0.401</b>	0.355	<b>0.381</b>	<b>0.429</b>	<b>0.4403</b>	0.348
Impaired Hearing (0/1)	7,607	0.013	0.006	0.015	0.021	0.022	0.007
		<b>0.049</b>	0.038	0.041	0.037	<b>0.065</b>	0.038
Wears glasses (0/1)	7,662	0.217	0.191	0.200	0.188	0.247	0.191
		<b>0.094</b>	0.066	<b>0.099</b>	0.056	0.085	0.067
Cross-eyed (0/1)	7,642	0.293	0.248	0.299	0.231	0.279	0.250
		<b>0.079</b>	0.052	<b>0.079</b>	0.048	<b>0.079</b>	0.053
Childcare:	10670	0.270	0.223	0.270	0.213	0.270	0.224
		<b>0.054</b>	0.034	<b>0.047</b>	<i>0.047</i>	<b>0.068</b>	0.033
Private care (0/1)	10670	0.226	0.181	0.211	0.212	0.252	0.177
		<i>0.889</i>	0.906	0.897	0.909	<b>0.872</b>	0.906
Centerbased care (0/1)	10670	0.314	0.291	0.304	0.287	0.334	0.292
Home care (0/1)	10670	0.037	0.035	0.034	0.029	0.043	0.036
		0.188	0.184	0.180	0.168	0.204	0.186

a. Means are tested against the mean of the Control Group. Significant differences are indicated by the font of the numbers. **Bold:** 5%-level; *italic*: 10%-level.

b. Height, impaired hearing, wears glasses and cross-eyedness are measured in 2001. The rest of the variables are measured before age 7, see Appendix B for details.

## IV. Baseline OLS Results

We begin by estimating the relationship between bullying and long-term outcomes using OLS. Our baseline estimating equation is

$$o = \beta bul + X'\gamma + \varepsilon$$

where  $o$  indicates the outcome of interest,  $bul$  is an indicator for being a victim of bullying at age 10-12 (alternatively a vector indicating whether the child is bullied, a bully, or a bully-victim),  $X$  is a rich conditioning set that includes the child and parental variables informative both about exposure to bullying and about outcomes. A selection of these variables are described in Section III above and a detailed list of the entire conditioning set is presented in Appendix B.  $\beta$  is our parameter(s) of interest.

**Table 3B** Means of Selected Characteristics of the Mother by Bullying Status<sup>a,b</sup>

	# obs	Simple bullying definition		Refined bullying definition			
		Victims Mean Std. Dev.	Controls Mean Std. Dev.	Victims Mean Std. Dev.	Bullies Mean Std. Dev.	Bully-Victims Mean Std. Dev.	Controls Mean Std. Dev.
Age at birth of child	10,900	<b>29.2</b> 4.9	29.8 4.5	29.6 4.9	<b>29.3</b> 4.7	<b>28.6</b> 5.0	29.8 4.4
Smoked (0/1)	6,529	<b>0.355</b> 0.016	0.256 0.008	<b>0.331</b> 0.020	<b>0.333</b> 0.026	<b>0.403</b> 0.028	0.247 0.009
Elementary school (0/1)	10,727	<b>0.258</b> 0.438	0.140 0.347	<b>0.229</b> 0.420	<b>0.212</b> 0.409	<b>0.319</b> 0.466	0.133 0.339
High school (0/1)	10,727	0.087 0.281	0.081 0.273	<b>0.098</b> 0.298	<i>0.101</i> 0.302	0.063 0.242	0.079 0.270
Vocational degree (0/1)	10,727	<b>0.322</b> 0.468	0.295 0.456	0.314 0.464	<i>0.330</i> 0.471	<b>0.340</b> 0.474	0.292 0.455
Short further education (0/1)	10,727	<b>0.034</b> 0.180	0.045 0.207	<i>0.034</i> 0.181	0.035 0.184	0.033 0.180	0.046 0.209
Medium further education (0/1)	10,727	<b>0.234</b> 0.424	0.319 0.466	<b>0.254</b> 0.436	<b>0.239</b> 0.427	<b>0.194</b> 0.396	0.327 0.469
Long further education (0/1)	10,727	<b>0.065</b> 0.246	0.120 0.325	<b>0.071</b> 0.257	<b>0.083</b> 0.276	<i>0.052</i> 0.222	0.123 0.329
Log income	10,841	<b>9.513</b> 4.812	10.544 3.991	<b>9.647</b> 4.698	<i>10.214</i> 4.290	<b>9.243</b> 5.028	10.579 3.958
Degree of year employed when child was 6 yrs.	10,841	<b>112.26</b> 232.06	80.33 192.21	<b>108.61</b> 227.69	87.35 203.63	<b>119.64</b> 240.69	79.59 190.99
Full time employment (0/1)	10,801	<b>0.765</b> 0.424	0.834 0.373	<b>0.774</b> 0.418	0.812 0.391	<b>0.747</b> 0.435	0.836 0.370
Top management level (0/1)	10,801	0.010 0.098	0.008 0.091	0.010 0.101	0.004 0.061	0.008 0.091	0.009 0.093
Higher management level (0/1)	10,801	<b>0.109</b> 0.312	0.178 0.382	<b>0.117</b> 0.322	<b>0.127</b> 0.333	<b>0.093</b> 0.291	0.183 0.387
Medium level employee (0/1)	10,801	<b>0.197</b> 0.398	0.283 0.450	<b>0.218</b> 0.413	<b>0.228</b> 0.420	<b>0.156</b> 0.363	0.289 0.453
Lower level employee (0/1)	10,801	<b>0.321</b> 0.467	0.272 0.445	<b>0.299</b> 0.458	<b>0.330</b> 0.471	<b>0.367</b> 0.483	0.266 0.442
Cardiovascular medicine (0/1)	10,907	0.148 0.355	0.145 0.352	0.133 0.340	<i>0.172</i> 0.378	<b>0.177</b> 0.382	0.142 0.349
Antidepressant medicine (0/1)	10,907	<b>0.260</b> 0.439	0.224 0.417	<i>0.248</i> 0.432	<b>0.270</b> 0.444	<b>0.284</b> 0.451	0.220 0.414
Diagnosis of mental or behavioral disorder (0/1)	10,907	<b>0.037</b> 0.005	0.022 0.002	<b>0.035</b> 0.006	<i>0.034</i> 0.008	<b>0.041</b> 0.008	0.021 0.002
Violence Conviction (0/1)	10,907	0.003 0.002	0.002 0.001	0.003 0.002	0.002 0.003	0.004 0.003	0.002 0.001
Property Conviction (0/1)	10,907	<b>0.059</b> 0.006	0.038 0.003	0.041 0.008	<b>0.071</b> 0.010	<b>0.095</b> 0.011	0.034 0.003
Prison Sentence (0/1)	10,907	<b>0.018</b> 0.003	0.007 0.002	0.012 0.004	0.014 0.005	<b>0.031</b> 0.006	0.006 0.002

a. Means are tested against the mean of the Control Group. Significant differences are indicated by the font of the numbers. **Bold:** 5%-level; *italic:* 10%-level.

b. Unless stated otherwise, the variables are measured before age 7, see Appendix B for details.

**Table 3C Means of Selected Characteristics of the Father by Bullying Status<sup>a,b</sup>**

	# obs	Simple bullying definition		Refined bullying definition			
		Victims	Controls	Victims	Bullies	Bully-Victims	Controls
		Mean Std. Dev.	Mean Std. Dev.	Mean Std. Dev.	Mean Std. Dev.	Mean Std. Dev.	Mean Std. Dev.
Age at birth of child	10,809	<b>31.8</b> 5.8	32.2 5.5	32.0 5.9	31.8 6.0	<b>31.3</b> 5.6	32.2 5.4
Elementary school (0/1)	10,438	<b>0.232</b> 0.422	0.132 0.339	<b>0.204</b> 0.404	<b>0.204</b> 0.403	<b>0.288</b> 0.453	0.125 0.331
High school (0/1)	10,438	0.070 0.256	0.073 0.259	0.084 0.277	0.061 0.240	<b>0.043</b> 0.204	0.074 0.261
Vocational degree (0/1)	10,438	<b>0.386</b> 0.487	0.343 0.475	<i>0.363</i> 0.481	<b>0.418</b> 0.494	<b>0.433</b> 0.496	0.335 0.472
Short further education (0/1)	10,438	0.047 0.212	0.051 0.219	0.054 0.226	0.044 0.205	<i>0.032</i> 0.177	0.051 0.221
Medium further education (0/1)	10,438	<b>0.142</b> 0.349	0.202 0.401	<b>0.153</b> 0.360	<b>0.132</b> 0.338	<b>0.119</b> 0.324	0.209 0.406
Long further education (0/1)	10,438	<b>0.123</b> 0.329	0.200 0.400	<b>0.142</b> 0.349	<b>0.141</b> 0.349	<b>0.084</b> 0.278	0.206 0.405
Log income	10,616	<b>10.759</b> 4.184	11.212 3.812	<b>10.877</b> 4.084	<b>10.433</b> 4.565	<b>10.518</b> 4.374	11.291 3.718
Degree of year employed (6 yrs.)	10,616	<b>60.23</b> 178.98	44.29 151.74	<b>58.18</b> 179.88	55.13 171.07	<b>64.41</b> 177.26	43.18 149.60
Full time employment (0/1)	10,606	<b>0.800</b> 0.400	0.843 0.364	<b>0.815</b> 0.389	<b>0.761</b> 0.427	<b>0.772</b> 0.420	0.852 0.355
Top management level (0/1)	10,606	0.041 0.197	0.044 0.205	0.042 0.200	0.034 0.181	0.038 0.192	0.045 0.207
Higher management level (0/1)	10,606	<b>0.181</b> 0.385	0.282 0.450	<b>0.207</b> 0.405	<b>0.198</b> 0.399	<b>0.130</b> 0.336	0.291 0.454
Medium level employee (0/1)	10,606	<b>0.129</b> 0.336	0.177 0.382	<b>0.140</b> 0.347	0.155 0.362	<b>0.108</b> 0.311	0.180 0.384
Lower level employee (0/1)	10,606	<b>0.314</b> 0.464	0.263 0.441	0.286 0.452	0.289 0.454	<b>0.372</b> 0.484	0.261 0.439
Cardiovascular medicine (0/1)	10,907	0.087 0.282	0.087 0.282	0.087 0.281	0.089 0.285	0.088 0.284	0.087 0.282
Antidepressant medicine (0/1)	10,907	<b>0.185</b> 0.389	0.154 0.361	<b>0.195</b> 0.396	<b>0.203</b> 0.403	0.167 0.373	0.148 0.356
Diagnosis of mental or behavioral disorder (0/1)	10,907	<b>0.042</b> 0.201	0.021 0.144	<b>0.039</b> 0.193	0.031 0.173	<b>0.049</b> 0.217	0.020 0.140
Violence Conviction (0/1)	10,907	<b>0.054</b> 0.005	0.023 0.003	<b>0.044</b> 0.007	<b>0.058</b> 0.009	<b>0.074</b> 0.009	0.020 0.003
Property Conviction (0/1)	10,907	<b>0.162</b> 0.009	0.108 0.005	<b>0.137</b> 0.011	<b>0.203</b> 0.015	<b>0.212</b> 0.016	0.098 0.005
Prison Sentence (0/1)	10,907	<b>0.113</b> 0.008	0.063 0.004	<b>0.099</b> 0.009	<b>0.145</b> 0.012	<b>0.142</b> 0.013	0.054 0.004

a. Means are tested against the mean of the Control Group. Significant differences are indicated by the font of the numbers. **Bold:** 5%-level; *italic*: 10%-level.

b. Unless stated otherwise, the variables are measured before age 7, see Appendix B for details.

Again, our primary conditioning set consists of variables measured before the child turns seven years old and enters school.<sup>12</sup> This is to avoid that included variables are affected by exposure to bullying. It implies, however, that we must interpret our parameter of interest as the effect of victimization in elementary school, generally speaking. Victimization could have started earlier on and it may very well continue afterwards.

<sup>12</sup> With the exception of height and minor physical disabilities.

### ***A. OLS Results***

OLS results for the simple and extended bullying definition are shown in Tables 4 and 5. The first row below each outcome reports the unadjusted OLS estimate while the second row reports the OLS estimates adjusted for the conditioning set. We see that when applying the simple definition of bullying, victims perform significantly worse than controls in terms of all outcomes. The size of the estimates is reduced somewhat by adjusting for background variables but in all cases except for criminal convictions and IQ, the estimates themselves are still significantly negative, both in a statistical and an economic sense: In Table 4 we see that being exposed to bullying is associated with a reduced 9<sup>th</sup> grade GPA of almost 20 % of a standard deviation (comparable to the effect of adding seven extra pupils to the classroom; see Heinesen (2010)), a 10 percentage point decrease in the likelihood of enrolling in high school compared to a mean among controls of 76 %, a 3 percentage point increase in the propensity to experience a teenage pregnancy compared to a mean of 5 %, a 4 percentage point increase in the use of psychopharmacological medication compared to a mean of 10 %, and a 2.5 kilogram increase in body weight at the military service test.

**Table 4** *The Effects of Bullying, Simple Bullying Definition*

	Victim		R <sup>2</sup> <sup>a</sup>	# obs.
Model	Coef.	Std.Err. <sup>a</sup>		
9th grade GPA				
OLS-unadjusted	<b>-0.337</b>	0.024	0.071	10,033
OLS-adjusted	<b>-0.174</b>	0.021	0.345	10,033
Mother FE	<b>-0.180</b>	0.090	0.226	963
OLS-Mother FE sample	<b>-0.189</b>	0.076	0.495	963
Class FE <sup>b</sup>	<b>-0.167</b>	0.024	0.301	9,746
School FE <sup>b</sup>	<b>-0.175</b>	0.026	0.303	10,012
High School Enrollment (0/1)				
OLS-unadjusted	<b>-0.209</b>	0.013	0.058	10,907
OLS-adjusted	<b>-0.109</b>	0.012	0.288	10,907
Mother FE	-0.084	0.058	0.193	1,057
OLS-Mother FE sample	<b>-0.140</b>	0.041	0.413	1,057
Class FE <sup>b</sup>	<b>-0.096</b>	0.011	0.247	10,595
School FE <sup>b</sup>	<b>-0.109</b>	0.015	0.255	10,880
Criminal Conviction (0/1)				
OLS-unadjusted	<b>0.029</b>	0.010	0.013	10,907
OLS-adjusted	-0.001	0.009	0.112	10,907
Mother FE	0.033	0.047	0.265	1,057
OLS-Mother FE sample	-0.015	0.032	0.240	1,057
Class FE <sup>b</sup>	-0.006	0.010	0.098	10,595
School FE <sup>b</sup>	-0.003	0.010	0.101	10,880
Teenage Pregnancy (0/1)				
OLS-unadjusted	<b>0.059</b>	0.011	0.008	5,309
OLS-adjusted	<b>0.032</b>	0.011	0.080	5,309
Mother FE	0.094	0.056	0.571	564
OLS-Mother FE sample	<b>0.100</b>	0.036	0.353	564
Class FE <sup>b</sup>	<b>0.028</b>	0.011	0.072	5,068
School FE <sup>b</sup>	<b>0.029</b>	0.010	0.077	5,288
Psychopharmacological Medication (0/1)				
OLS-unadjusted	<b>0.056</b>	0.009	0.006	10,907
OLS-adjusted	<b>0.040</b>	0.009	0.058	10,907
Mother FE	-0.028	0.051	0.180	1,057
OLS-Mother FE sample	<b>0.071</b>	0.031	0.149	1,057
Class FE <sup>b</sup>	<b>0.043</b>	0.008	0.056	10,595
School FE <sup>b</sup>	<b>0.039</b>	0.008	0.056	10,880

**Bold:** significant at the 5 % level. *Italic:* significant at the 10 % level.

Conditioning set described in Section III (see Table B1 in Appendix B)

a. For fixed effects we report robust standard errors and the within R<sup>2</sup>.

b. The unadj. and adj. OLS estimates for the school and class FE samples do not differ significantly from the unadj. and adj. OLS estimates for the entire sample. This holds for all outcomes.



**Table 4** (*Continued*)

	Victim		R <sup>2 a</sup>	# obs.
Model	Coef.	Std.Err. <sup>a</sup>		
<i>IQ - Military Service Test</i>				
OLS-unadjusted	<b>-1.865</b>	0.453	0.044	4025
OLS-adjusted	-0.399	0.422	0.233	4025
Class FE <sup>b</sup>	-0.322	0.392	0.196	3772
School FE <sup>b</sup>	-0.445	0.361	0.199	4009
<i>Weight - Military Service Test</i>				
OLS-unadjusted	<b>3.087</b>	0.678	0.005	4057
OLS-adjusted	<b>2.527</b>	0.648	0.159	4057
Class FE <sup>b</sup>	<b>2.309</b>	0.563	0.160	3803
School FE <sup>b</sup>	<b>2.396</b>	0.569	0.157	4041

**Bold:** significant at the 5 % level. *Italic:* significant at the 10 % level.

Conditioning set described in Section III (see Table B1 in Appendix B)

a. For fixed effects we report robust standard errors and the within  $R^2$ .

b. The unadj. and adj. OLS estimates for the school and class FE samples do not differ significantly from the unadj. and adj. OLS estimates for the entire sample. This holds for all outcomes.

Applying the refined bullying definition reveals that not only victims but also bullies and bully-victims experience worse outcomes than children not involved in conflict. Being a victim of bullying reduces educational achievement and health outcomes compared to non-involved individuals, while being a perpetrator reduces educational achievement and increases the probability of a criminal conviction. In addition, we see that bullies are observed to perform worse in the IQ test at the conscription examination compared to the controls, which suggests that prior bullies systematically manipulate their test performance in an attempt to avoid being drafted for the military. IQ itself becomes stable around age 10 or so (Schuerger and Witt, 1989), and it should not be affected by bullying. Table 5 reveals that for education outcomes and teenage pregnancy the point estimates of being a bully-victim are higher than for pure victims and pure bullies. This is in line with previous research indicating that this is a particularly vulnerable group (Pollastri et al., 2010).

**Table 5** *The Effects of Bullying, Refined Bullying Definition*

	Victim		Bully		Bully-Victim		R <sup>2</sup> <sup>a</sup>	# obs.
Model	Coef.	Std.Err. <sup>a</sup>	Coef.	Std.Err. <sup>a</sup>	Coef.	Std.Err. <sup>a</sup>		
9th grade GPA								
OLS-unadjusted	<b>-0.270</b>	0.028	<b>-0.419</b>	0.036	<b>-0.600</b>	0.040	0.088	10,033
OLS-adjusted	<b>-0.150</b>	0.024	<b>-0.217</b>	0.031	<b>-0.293</b>	0.035	0.349	10,033
Mother FE	<b>-0.320</b>	0.102	<b>-0.269</b>	0.132	-0.033	0.132	0.241	963
OLS-Mother FE sample	<b>-0.240</b>	0.092	-0.085	0.113	-0.128	0.113	0.496	963
Class FE <sup>b</sup>	<b>-0.146</b>	0.035	<b>-0.228</b>	0.030	<b>-0.293</b>	0.028	0.305	9,746
School FE <sup>b</sup>	<b>-0.152</b>	0.034	<b>-0.222</b>	0.028	<b>-0.298</b>	0.030	0.314	10,012
High School Enrollment (0/1)								
OLS-unadjusted	<b>-0.176</b>	0.016	<b>-0.220</b>	0.021	<b>-0.337</b>	0.022	0.071	10,907
OLS-adjusted	<b>-0.103</b>	0.014	<b>-0.106</b>	0.018	<b>-0.157</b>	0.020	0.291	10,907
Mother FE	-0.122	0.075	-0.053	0.085	-0.032	0.086	0.196	1,057
OLS-Mother FE sample	<b>-0.178</b>	0.050	-0.043	0.063	-0.093	0.062	0.414	1,057
Class FE <sup>b</sup>	<b>-0.093</b>	0.014	<b>-0.105</b>	0.015	<b>-0.140</b>	0.016	0.249	10,595
School FE <sup>b</sup>	<b>-0.102</b>	0.017	<b>-0.105</b>	0.014	<b>-0.157</b>	0.019	0.258	10,880
Criminal Conviction (0/1)								
OLS-unadjusted	0.006	0.012	<b>0.152</b>	0.015	<b>0.118</b>	0.016	0.025	10,907
OLS-adjusted	-0.009	0.011	<b>0.089</b>	0.014	<b>0.044</b>	0.015	0.115	10,907
Mother FE	0.068	0.051	<b>0.168</b>	0.065	0.049	0.072	0.274	1,057
OLS-Mother FE sample	0.003	0.039	<b>0.165</b>	0.049	0.002	0.048	0.249	1,057
Class FE <sup>b</sup>	-0.012	0.011	<b>0.090</b>	0.014	<b>0.040</b>	0.015	0.102	10,595
School FE <sup>b</sup>	-0.011	0.011	<b>0.089</b>	0.015	<b>0.043</b>	0.014	0.105	10,880
Teenage Pregnancy (0/1)								
OLS-unadjusted	<b>0.050</b>	0.012	<b>0.050</b>	0.023	<b>0.100</b>	0.021	0.010	5,309
OLS-adjusted	<b>0.028</b>	0.012	0.029	0.022	<b>0.053</b>	0.021	0.081	5,309
Mother FE	-0.010	0.071	0.003	0.253	<i>0.261</i>	0.145	0.587	564
OLS-Mother FE sample	<b>0.091</b>	0.043	0.017	0.080	<b>0.123</b>	0.060	0.353	564
Class FE <sup>b</sup>	<b>0.024</b>	0.012	0.027	0.019	<b>0.052</b>	0.023	0.072	5,068
School FE <sup>b</sup>	<b>0.025</b>	0.009	0.024	0.019	<b>0.047</b>	0.022	0.077	5,288
Psychopharmacological Medication (0/1)								
OLS-unadjusted	<b>0.056</b>	0.011	0.002	0.014	<b>0.057</b>	0.015	0.006	10,907
OLS-adjusted	<b>0.039</b>	0.011	0.011	0.014	<b>0.048</b>	0.015	0.058	10,907
Mother FE	0.060	0.055	<i>0.120</i>	0.067	-0.146	0.094	0.198	1,057
OLS-Mother FE sample	<b>0.075</b>	0.037	<b>0.131</b>	0.047	<b>0.102</b>	0.046	0.156	1,057
Class FE <sup>b</sup>	<b>0.042</b>	0.009	0.005	0.011	<b>0.047</b>	0.013	0.056	10,595
School FE <sup>b</sup>	<b>0.038</b>	0.009	0.010	0.009	<b>0.045</b>	0.014	0.056	10,880

**Bold:** significant at the 5 % level. *Italic:* significant at the 10 % level.

Conditioning set described in Section III (see Table B1 in Appendix B)

a. For fixed effects we report robust standard errors and the within R<sup>2</sup>.

b. The unadj. and adj. OLS estimates for the school and class FE samples do not differ significantly from the unadj. and adj. OLS estimates for the entire sample. This holds for all outcomes.

**Table 5 (Continued)**

	Victim		Bully		Bully-Victim		R <sup>2</sup> <sup>a</sup>	# obs.
Model	Coef.	Std.Err. <sup>a</sup>	Coef.	Std.Err. <sup>a</sup>	Coef.	Std.Err. <sup>a</sup>		
<i>IQ - Military Service Test</i>								
OLS-unadjusted	-0.664	0.567	<b>-4.332</b>	0.577	<b>-4.946</b>	0.664	0.063	4025
OLS-adjusted	0.314	0.527	<b>-2.754</b>	0.540	<b>-2.397</b>	0.623	0.240	4025
Class FE <sup>b</sup>	0.180	0.418	<b>-3.399</b>	0.647	<b>-2.411</b>	0.913	0.207	3772
School FE <sup>b</sup>	0.171	0.461	<b>-2.763</b>	0.771	<b>-2.309</b>	0.878	0.206	4009
<i>Weight - Military Service Test</i>								
OLS-unadjusted	<b>3.704</b>	0.858	-0.008	0.874	<b>2.209</b>	1.001	0.005	4057
OLS-adjusted	<b>2.925</b>	0.814	-0.063	0.834	<b>1.929</b>	0.959	0.159	4057
Class FE <sup>b</sup>	<b>3.041</b>	0.625	0.769	0.955	<i>1.525</i>	0.883	0.161	3803
School FE <sup>b</sup>	<b>2.809</b>	0.763	0.029	0.588	<b>1.805</b>	0.734	0.157	4041

**Bold:** significant at the 5 % level. *Italic:* significant at the 10 % level.

Conditioning set described in Section III (see Table B1 in Appendix B)

a. For fixed effects we report robust standard errors and the within R<sup>2</sup>.

b. The unadj. and adj. OLS estimates for the school and class FE samples do not differ significantly from the unadj. and adj. OLS estimates for the entire sample. This holds for all outcomes.

## V. Identifying Causal Relationships

The key problem facing us is that it is not random who is bullied (and who engages in bullying). In fact, as indicated by the literature review and our descriptive statistics above, victims and bullies are negatively selected in terms of observable characteristics. Moreover, children involved in conflict are also likely to be negatively selected in terms of *unobservable* characteristics. Failure to take these factors into account will likely overstate the effects of bullying.

We therefore pursue a number of strategies to assess whether the correlations documented so far are causal. We first combine our rich conditioning set with mother fixed effects. Second, we incorporate classroom and school fixed effects. Third, we account for detailed measures of ability and behavior measured just prior to exposure to bullying. For a subset of the children in our sample we also have access to this type of information measured at age 3.5. Fourth, we

follow Altonji, Elder, and Taber (2005) and use selection on observable variables to assess the likelihood that our estimates are driven by selection on unobservables. Finally, we perform a falsification test using adult height as outcome, in the spirit of Havnes and Mogstad (2011).

### ***A. Mother Fixed Effects***

As mentioned above bullying seems to be related to standard socio-economic measures such as family resources and ethnic origin as well as personal characteristics such as personality traits, disabilities, physical appearance, and physical weakness/strength. To the extent that these characteristics are fixed within a family, a mother fixed effects estimator will account for them.

Our data allow us to account for mother fixed effects for siblings who are born within the 1990-1992 time period. That is, we consider closely spaced siblings. In the analysis of the effects of simple victimization, we exploit sibling pairs where one sibling is the victim of bullying and the other is not. The outcome of the non-victim sibling can then be used as the counterfactual outcome. A similar strategy is used when considering our refined bullying definition.

The fixed effects strategy assumes that comparing siblings, perhaps conditional on attributes, eliminates selective differences between victims and controls. A common concern is exactly that although siblings are born into the same family and share this environment, they may still differ along a wide range of characteristics. If less able siblings are more likely to be exposed to bullying, the sibling comparison estimator will tend to bias the effect of bullying upwards, just as the simple OLS is expected to do. To accommodate this criticism, our estimations include a wide range of variables descriptive of the child himself and his abilities; see above.

A second concern with within-family estimators is that the identifying population is potentially very small. 525 mothers from our survey gave birth to more than one child during

1990-1992 (145 gave birth to twins, 4 gave birth to triplets). Of these, we observe 77 sibling pairs where one is a victim of bullying and the other is not; these pairs identify our parameter of interest in the sibling analysis.<sup>13</sup> Table 6 shows the percentages of sibling pairs in the different combinations of bullying status.<sup>14</sup> Bullying status of the oldest sibling is on the vertical axis and bullying status of the younger sibling is on the horizontal axis. It does not seem as if the younger sibling is more likely to be a victim of bullying if the older sibling is a victim of bullying and vice versa.

Finally, we assume that one sibling is not affected if the other sibling is exposed to bullying. Such negative spillovers will cause a bias towards zero in the fixed effects estimations.

**Table 6** *Sibling Variation in Bullying Status*

		Sibling 2:			
		Simple bullying definition		Refined bullying definition	
		Victim	Control	Victim	Bully
				Bully-Victim	Control
Simple bullying def.					
Victim		9%	12%		
Control		15%	65%		
Sibling 1: Refined bullying def.					
Victim				3%	1%
Bully				1%	2%
Bully-Victim				2%	1%
Control				7%	5%

We report the coefficients for the mother fixed effects specification in the third row below each outcome in Tables 4 and 5 (apart from IQ and weight, where we have too few observations for mother fixed effects). As the sample size decreases significantly when we

<sup>13</sup> Of these 77 sibling pairs 19 are twin pairs.

<sup>14</sup> Families who give birth to more than 2 children in the period constitute 2 sibling pairs; sibling 2 and 3 are each paired with sibling 1.

run the mother fixed effects model we also report the adjusted OLS estimates for this reduced sample in row four. We report robust standard errors and the within R-squared.<sup>15</sup>

The important message from the mother fixed effects analysis is that the conclusions from the simple OLS seem robust. Even when we control for factors that are fixed within the family, bullying has severe negative consequences. However, the estimates for the relatively infrequent outcomes of teenage pregnancy and psychopharmacological medication are now insignificant and imprecisely estimated.

### ***B. Classroom and School Fixed Effects***

Among institutional characteristics, the previous literature indicates that class size is perhaps of less importance, while school and teacher characteristics or fixed effects should be included to account for anti-bullying prevention and related policies as well as selection of certain types of children into schools and classrooms. Our second strategy incorporates these fixed effects.<sup>16</sup> Any moderating effects of class size on bullying will be captured by such a strategy too. Again, we report robust standard errors and the within R-squared. Rows five and six in Tables 4 and 5 show the results which corroborate the findings from above.

### ***C. Controlling for Prior Ability, Behavior, and Bullying***

Our primary conditioning set does not explicitly include information about child behavior and ability. Yet the 2001 questionnaire does include additional variables such as child behavior

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<sup>15</sup> Additional test statistics, such as F-test of joint significance of the fixed effects and a Hausman test of fixed effects versus random effects are available on request.

<sup>16</sup> Adjusted OLS estimates were also conducted for the reduced samples in the class and school fixed effects models. Here the coefficients did not differ significantly from the adjusted OLS estimates of the full sample.

measures (from the Child Behavior Checklist), information about leisure activities, learning difficulties etc. These variables may serve as better proxies for unobserved variables such as ability and personality than those included previously. It is possible, however, that some of these variables are affected by victimization due to the short time that elapsed between the conduction of the two questionnaires. We first explain the extended conditioning set in detail before presenting the results in Tables 7 and 8.

*Leisure and development:* The 2001 questionnaire contain relevant questions on early child development such at the age at which the child started walking, whether he had a late speech development and whether he received any help with the speech development. These variables may serve as proxies for early social ability since especially late speech development may affect the child's willingness and ability to communicate with others as well as affect its self esteem. The questionnaire also contains information about the weight and height of the child in 2001. Using these we calculate the Body Mass Index of the child. Overweight in adolescent is associated with higher prevalence of depressive symptoms, lower self esteem and social isolation.<sup>17</sup> Strauss and Pollack (2003) find that overweight adolescents were less likely to receive friendship nominations compared to their normal-weight peers. Several studies have found that that overweight children are more likely to get stigmatized by their peers. One study suggests that bias toward overweight people is formed at the age of 8, while other work shows anti-fat attitudes in 3-year-old preschool children.<sup>18</sup> We therefore expect overweight children to be more exposed to bullying. We also include a dummy for whether the child has a best friend, as well as a wide range of variables indicating how much time the child spends during the week watching television, practice sports, read, played with friends etc.

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<sup>17</sup> See for example Erickson et al (2000).

<sup>18</sup> See Puhl and Brownell (2001) for an overview of the findings in the literature.

*Behavior:* The 2001 questionnaire includes a range of questions about child development from the Child Behavior Checklist (CBCL). Unfortunately not all items within each factor were asked and therefore it has not been possible to estimate the factors from the CBCL. Instead we conduct our own factor analysis inspired by Behar's Preschool Behavior Questionnaire. We obtain four factors; *anxious*, *hyperactive*, *empathic*, and *absent minded*, using explorative principal component analysis.<sup>19</sup> We expect these behavioral variables to affect the probability of being victimized because they are closely related to the two prototypical victims: the passive and the provocative victim. Behavior might also very well influence each of the outcomes school achievement, health and risky behavior.

*Learning Difficulties:* The parents have indicated whether their child face problems with concentration as well as learning to read, spell and do math. We expect that the children who find it more difficult to acquire these basic skills will also perform worse in school. At the same time we also expect these difficulties to affect the child's likelihood of being victimized.

*Bullying:* Finally, the parents are asked whether their child bullies others or is being bullied himself in 2001. We add this information to the conditioning set in an attempt to isolate the effect of current exposure to bullying.

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<sup>19</sup> A description of the full factor analyses including validity measures is available on request.



**Table 7** *Robustness Analysis - The Effects of Bullying, Simple Bullying Definition*

	Victim		R <sup>2</sup>	# obs.
	Coef.	Std.Err.		
<i>9th grade GPA</i>				
OLS-adjusted	<b>-0.176</b>	0.021	0.338	10,033
+ Leisure etc.	<b>-0.173</b>	0.021	0.365	10,033
+ Behavior	<b>-0.122</b>	0.021	0.374	10,033
+ Learning difficulties	<b>-0.104</b>	0.021	0.397	10,033
+ Bullying	<b>-0.097</b>	0.021	0.398	10,033
<i>High School Enrollment (0/1)</i>				
OLS-adjusted	<b>-0.111</b>	0.012	0.284	10,907
+ Leisure etc.	<b>-0.094</b>	0.012	0.308	10,907
+ Behavior	<b>-0.065</b>	0.012	0.316	10,907
+ Learning difficulties	<b>-0.055</b>	0.012	0.339	10,907
+ Bullying	<b>-0.055</b>	0.013	0.339	10,907
<i>Criminal Conviction (0/1)</i>				
OLS-adjusted	-0.001	0.009	0.112	10,907
+ Leisure etc.	0.004	0.010	0.116	10,907
+ Behavior	-0.007	0.010	0.118	10,907
+ Learning difficulties	-0.007	0.010	0.120	10,907
+ Bullying	-0.008	0.010	0.121	10,907
<i>Teenage Pregnancy (0/1)</i>				
OLS-adjusted	<b>0.032</b>	0.011	0.074	5,309
+ Leisure etc.	<b>0.035</b>	0.011	0.080	5,309
+ Behavior	<b>0.033</b>	0.012	0.082	5,309
+ Learning difficulties	<b>0.033</b>	0.012	0.083	5,309
+ Bullying	<b>0.030</b>	0.012	0.085	5,309
<i>Psychopharmacological Medication (0/1)</i>				
OLS-adjusted	<b>0.040</b>	0.009	0.058	10,907
+ Leisure etc.	<b>0.036</b>	0.009	0.061	10,907
+ Behavior	<b>0.022</b>	0.010	0.067	10,907
+ Learning difficulties	<b>0.022</b>	0.010	0.067	10,907
+ Bullying	0.011	0.010	0.070	10,907
<i>IQ - Military Service Test</i>				
OLS-adjusted	-0.418	0.422	0.230	4,025
+ Leisure etc.	-0.322	0.419	0.263	4,025
+ Behavior	0.099	0.432	0.273	4,025
+ Learning difficulties	0.483	0.422	0.311	4,025
+ Bullying	0.366	0.439	0.314	4,025
<i>Weight - Military Service Test</i>				
OLS-adjusted	<b>2.564</b>	0.648	0.154	4,057
+ Leisure etc.	<b>1.649</b>	0.606	0.283	4,057
+ Behavior	<b>1.496</b>	0.629	0.284	4,057
+ Learning difficulties	<b>1.507</b>	0.630	0.286	4,057
+ Bullying	<i>1.244</i>	0.657	0.287	4,057

**Bold:** significant at the 5 % level. *Italic:* 10 % level. Conditioning set described in Appendix B.

**Table 8** *Robustness Analysis - The Effects of Bullying, Refined Bullying Definition*

	Victim		Bully		Bully-Victim		R <sup>2</sup>	# obs.
	Coef.	Std.Err.	Coef.	Std. Err.	Coef.	Std. Err.		
<i>9th grade GPA</i>								
OLS-adjusted	<b>-0.150</b>	0.024	<b>-0.228</b>	0.032	<b>-0.303</b>	0.035	0.343	10,033
+ Leisure etc.	<b>-0.153</b>	0.024	<b>-0.213</b>	0.031	<b>-0.284</b>	0.034	0.368	10,033
+ Behavior	<b>-0.122</b>	0.024	<b>-0.179</b>	0.031	<b>-0.195</b>	0.036	0.376	10,033
+ Learning difficulties	<b>-0.094</b>	0.024	<b>-0.173</b>	0.031	<b>-0.198</b>	0.035	0.400	10,033
+ Bullying	<b>-0.087</b>	0.025	<b>-0.171</b>	0.031	<b>-0.192</b>	0.035	0.400	10,033
<i>High School Enrollment (0/1)</i>								
OLS-adjusted	<b>-0.104</b>	0.014	<b>-0.111</b>	0.018	<b>-0.162</b>	0.020	0.287	10,907
+ Leisure etc.	<b>-0.090</b>	0.014	<b>-0.101</b>	0.018	<b>-0.137</b>	0.019	0.310	10,907
+ Behavior	<b>-0.070</b>	0.014	<b>-0.079</b>	0.018	<b>-0.085</b>	0.020	0.317	10,907
+ Learning difficulties	<b>-0.057</b>	0.014	<b>-0.075</b>	0.018	<b>-0.083</b>	0.020	0.340	10,907
+ Bullying	<b>-0.057</b>	0.015	<b>-0.076</b>	0.018	<b>-0.085</b>	0.020	0.340	10,907
<i>Criminal Conviction (0/1)</i>								
OLS-adjusted	-0.009	0.011	<b>0.089</b>	0.014	<b>0.044</b>	0.015	0.115	10,907
+ Leisure etc.	-0.004	0.011	<b>0.090</b>	0.014	<b>0.049</b>	0.016	0.120	10,907
+ Behavior	-0.009	0.011	<b>0.084</b>	0.015	<b>0.034</b>	0.016	0.122	10,907
+ Learning difficulties	-0.010	0.011	<b>0.081</b>	0.015	<b>0.033</b>	0.016	0.123	10,907
+ Bullying	-0.010	0.012	<b>0.077</b>	0.015	<i>0.028</i>	0.016	0.124	10,907
<i>Teenage Pregnancy (0/1)</i>								
OLS-adjusted	<b>0.027</b>	0.012	0.033	0.022	<b>0.058</b>	0.021	0.074	5,309
+ Leisure etc.	<b>0.031</b>	0.012	0.034	0.022	<b>0.055</b>	0.022	0.081	5,309
+ Behavior	<b>0.031</b>	0.013	0.034	0.023	<b>0.055</b>	0.022	0.082	5,309
+ Learning difficulties	<b>0.031</b>	0.013	0.033	0.023	<b>0.051</b>	0.022	0.084	5,309
+ Bullying	<b>0.029</b>	0.013	0.029	0.023	<b>0.046</b>	0.023	0.085	5,309
<i>Psychopharmacological Medication (0/1)</i>								
OLS-adjusted	<b>0.039</b>	0.011	0.011	0.014	<b>0.048</b>	0.015	0.058	10,907
+ Leisure etc.	<b>0.035</b>	0.011	0.011	0.014	<b>0.041</b>	0.015	0.062	10,907
+ Behavior	<b>0.025</b>	0.011	0.004	0.014	0.017	0.016	0.067	10,907
+ Learning difficulties	<b>0.025</b>	0.011	0.004	0.014	0.017	0.016	0.067	10,907
+ Bullying	0.013	0.012	0.002	0.014	0.006	0.016	0.070	10,907
<i>IQ - Military Service Test</i>								
OLS-adjusted	0.314	0.527	<b>-2.843</b>	0.536	<b>-2.480</b>	0.622	0.238	4,025
+ Leisure etc.	0.241	0.524	<b>-2.570</b>	0.531	<b>-2.044</b>	0.617	0.269	4,025
+ Behavior	0.400	0.528	<b>-2.411</b>	0.534	<b>-1.448</b>	0.645	0.278	4,025
+ Learning difficulties	<i>0.893</i>	0.516	<b>-2.264</b>	0.521	<i>-1.171</i>	0.628	0.316	4,025
+ Bullying	0.745	0.531	<b>-2.297</b>	0.525	<b>-1.323</b>	0.642	0.318	4,025
<i>Weight - Military Service Test</i>								
OLS-adjusted	<b>2.943</b>	0.815	-0.116	0.830	<b>1.975</b>	0.960	0.154	4,057
+ Leisure etc.	<b>1.966</b>	0.762	-0.528	0.772	1.007	0.895	0.283	4,057
+ Behavior	<b>1.839</b>	0.772	-0.655	0.781	0.667	0.940	0.284	4,057
+ Learning difficulties	<b>1.811</b>	0.773	-0.673	0.782	0.733	0.940	0.286	4,057
+ Bullying	<i>1.549</i>	0.797	-0.743	0.788	0.415	0.962	0.288	4,057

**Bold:** significant at the 5 % level. *Italic:* significant at the 10 % level. Conditioning set described in App. B.

Tables 7 and 8 add these groups of variables in a sequential manner. First note that adding this richer set of information is important in terms of the size of the estimated effects. Regardless, bullying is still associated with strong reductions in GPA and high school enrollment as well as an increased risk of experiencing a teenage pregnancy (girls), increased use of psychopharmacological medication and higher body weight (boys). For body weight,  $R^2$  increases from 15% to 28%, when the variables related to *Leisure and Development* are added because this set of variables includes body mass index as measured in year 2001, which is of course a strong predictor of body weight at age 18. Table 8 confirms the pattern seen in Table 5 that being a bully-victim is associated with the least favorable outcomes in terms of education and teenage pregnancy.

A subgroup of the participants recruited in 1990-1992 was asked to complete a questionnaire when the child was three-and-a-half years old (around 1,700 children). The questionnaire obtained information on the child's behavioral and linguistic development. We conducted a principal component factor analysis based on Behar's Preschool Behavior Questionnaire in order to obtain three variables describing the child's behavior: *hostile-aggressive*, *anxious-fearful* and *hyperactive-distractible*. In order to proxy early ability we also control for a wide range of questions regarding the child's linguistic development.

Results from this additional robustness analysis are consistent with the results reported above and available on request. However, we saw above that including measures of ability and behavior in 2001 reduced the size of the estimated effects associated with bullying. The same is not true for information measured at age 3.5. Presumably, information measured later more precisely describes the individual than does information measured very early. It is difficult to make strong conclusions based on this small sample, though.

#### ***D. Using Selection on Observables to Assess the Bias from Unobservables***

Despite the attempts to control observed and unobserved factors associated with bullying and outcomes, our estimates may still be biased. Our fourth strategy uses the degree of selection on observables in the adjusted OLS regression to assess the bias arising from selection on unobservables as suggested by Altonji et al. (2005). Specifically, let

$$o = \beta \cdot bul + W'\Gamma = \beta \cdot bul + X'\Gamma_x + \xi,$$

where  $W$  are all the variables that explain our outcome apart from exposure to bullying. We only observe  $X$ , however. If we project  $o$  onto the bullying indicator and our observables  $X$  we get

$$o = \beta \cdot bul + X'\gamma + \varepsilon,$$

where  $\gamma$  is defined such that  $X$  and  $\varepsilon$  are uncorrelated. Imagine that we project the underlying latent bullying variable onto  $X'\gamma$  and  $\varepsilon$ :

$$Proj(Bul^*|X'\gamma, \varepsilon) = \phi_0 + \phi_{x'\gamma}X'\gamma + \phi_\varepsilon\varepsilon$$

The procedure then assumes that selection on unobservables is the same as selection on observables. Loosely speaking the part of the outcome “that is related to the observables and the part related to unobservables have the same relationship” (Altonji et al. (2005) p. 169) with exposure to bullying. Formally,

$$\phi_{x'\gamma} = \phi_\varepsilon$$

Given this, Altonji et al. (2005) then measure the ratio of selection on unobservables to observables that would be necessary to fully explain the estimated effect of bullying. Table 9 presents these ratios for all outcomes but criminal convictions, where the estimated effect was not significant (corresponding to “OLS adjusted”, Table 4). We see that selection on

unobservables should be between 1.54 and 3.37 times as large as selection on observables in order to fully account for the estimated effect of bullying on educational outcomes. Given the richness of our conditioning set and the time elapsed between measuring bullying status and outcomes, we believe this to be unlikely. For teenage pregnancy and medication, the ratio is somewhat lower because the outcomes are less frequent and  $R^2$  are much smaller (6-8%) compared to the educational outcomes (around 30%). For body weight, the ratio is also relatively low because this variable has a high variance.

**Table 9** *Ratio of Unobservables to Observables Needed to Explain the Effect of Bullying,*

<i>Simple Bullying Definition</i> *	
	Implied ratio
9th grade GPA	3.37
High School Enrollment (0/1)	1.54
Teenage Pregnancy (0/1)	0.16
Medication (0/1)	0.39
IQ	-5.41
Weight	0.53

\* Results are based on the conditioning set in described in Section III (see Table B1 in Appendix B) and rely on a constrained regression with  $\beta = 0$ . See Altonji, Elder and Taber (2005) for details.

#### ***E. Falsification Test: The Effect of Bullying on Adult Height***

Our final analysis is a falsification test where we use adult height as a potential “outcome” of bullying. Presumably, height in adulthood is largely determined genetically and by early-life events and not affected by exposure to bullying in elementary school. In addition, taller adults have, on average, higher education and incomes. A significant “effect” of bullying on height would therefore be a sign of omitted variables bias, see Havnes and Mogstad (2011) for a similar use of height.

Tables 10 and 11 show the results from this falsification exercise for the simple and the refined bullying definition, respectively. When we use the refined bullying definition, the unconditional correlation between being a bully and adult height is significantly positive at the 10%-level. This relationship disappears when the coefficient is adjusted for confounding variables.

**Table 10** *The Effect of Bullying on Adult Height (cm), Simple Bullying Definition*

	Victim		R <sup>2</sup> <sup>a</sup>	# obs.
Model	Coef.	Std.Err. <sup>a</sup>		
<i>Height - Military Service Test</i>				
OLS-unadjusted	-0.064	0.329	0.003	4058
OLS-adjusted	0.117	0.282	0.322	4058
Class FE <sup>b</sup>	-0.011	0.238	0.332	3804
School FE <sup>b</sup>	0.138	0.242	0.318	4042

**Bold:** significant at the 5 % level. *Italic:* significant at the 10 % level.

Conditioning set described in Section III and Appendix B.

a. For fixed effects we report robust standard errors and the within  $R^2$ . The F-test of joint significance of the FE and the Hausman test of FE vs. RE are reported in the appendix.

b. The unadj. and adj. OLS estimates for the school and class FE samples do not differ significantly from the unadj. and adj. OLS estimates for the entire sample. This holds for all outcomes.

**Table 11** *The Effect of Bullying on Adult Height (cm), Refined Bullying Definition*

	Victim		Bully		Bully-Victim		R <sup>2</sup> <sup>a</sup>	# obs.
Model	Coef.	Std.Err. <sup>a</sup>	Coef.	Std.Err. <sup>a</sup>	Coef.	Std.Err. <sup>a</sup>		
<i>Height - Military Service Test</i>								
OLS-unadjusted	0.086	0.416	-0.724	0.424	-0.502	0.486	0.004	4058
OLS-adjusted	-0.119	0.355	-0.049	0.361	0.472	0.418	0.320	4058
Class FE <sup>b</sup>	-0.193	0.296	0.156	0.317	0.481	0.328	0.326	3905
School FE <sup>b</sup>	-0.047	0.315	-0.006	0.253	0.474	0.305	0.315	4042

**Bold:** significant at the 5 % level. *Italic:* significant at the 10 % level.

Conditioning set described in Section III and Appendix B

a. For fixed effects we report robust standard errors and the within  $R^2$ . The F-test of joint significance of the FE and the Hausman test of FE vs. RE are reported in the appendix.

b. The unadj. and adj. OLS estimates for the school and class FE samples do not differ significantly from the unadj. and adj. OLS estimates for the entire sample. This holds for all outcomes.

## VI. Mechanism: Teacher Perceptions

We next investigate a possible short-term mechanism that may drive long-term effects, namely teacher perceptions of abilities and behavior measured in 2002. These could have long-term consequences, both because they represent immediate causal effects of bullying on the child but also because they may affect teachers' confidence in and willingness to invest in victims and bullies. According to Patterson et al. (1992), that is how antisocial behavior manifests itself: child behavior at one stage leads to predictable reactions from the environment in the subsequent stage. We caution that since teachers' evaluations are measured at the same point in time as bullying, there may be simultaneity bias present. We interpret the results accordingly.

The short-run outcomes used in the analyses are the pupil's cognitive and behavioral skills as rated by the teacher on a 5-point scale compared to typical pupils in the same grade (much below, somewhat below, at the average, somewhat above, much above). We consider teacher evaluated performance in reading and math, children's effort level, behavior, ability to learn, mood, and social competencies.<sup>20</sup>

**Table 12** *The Effects of Bullying on Teacher Rated Outcomes, Refined Bullying Definition*

	Victim		Bully		Bully-Victim		R <sup>2</sup>	# obs.
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.		
<i>Reading</i>	<b>-0.300</b>	0.038	<b>-0.156</b>	0.046	<b>-0.346</b>	0.050	0.156	5,557
<i>Math</i>	<b>-0.245</b>	0.040	<b>-0.234</b>	0.048	<b>-0.505</b>	0.052	0.161	4,965
<i>Effort</i>	<b>-0.278</b>	0.036	<b>-0.487</b>	0.043	<b>-0.721</b>	0.047	0.246	5,609
<i>Behavior</i>	<b>-0.196</b>	0.035	<b>-0.944</b>	0.042	<b>-1.159</b>	0.046	0.279	5,599
<i>Ability to learn</i>	<b>-0.299</b>	0.038	<b>-0.206</b>	0.045	<b>-0.503</b>	0.049	0.184	5,595
<i>Mood</i>	<b>-0.491</b>	0.039	<b>-0.444</b>	0.046	<b>-1.061</b>	0.050	0.146	5,574
<i>Social Competencies</i>	<b>-0.586</b>	0.036	<b>-0.734</b>	0.043	<b>-1.207</b>	0.047	0.238	5,598

**Bold:** significant at the 5 % level. *Italic:* significant at the 10 % level.

Conditioning set described in Section III (see Table B1 in Appendix B)

<sup>20</sup> Performance is standardized to zero mean and unit standard deviation.

Table 12 shows the adjusted OLS results using our primary conditioning set for the refined bullying definition. Results are robust to adding fixed effects and the more detailed conditioning set including information on behavior, ability, and bullying from 2001. All are available on request.

We see that teachers perceive bully-victims to have the lowest ratings on *all* outcomes considered, which is even more extreme than what was found based on register-based outcomes above. Teachers perceive bullied children to be particularly weak in terms of academic skills. They also view bullied children to have worse mood and worse social competencies. All groups are considered to have worse behavior than controls.

An alternative strategy would be to include these intermediate variables potentially affected by bullying in our main model and investigate whether this drives results. We have done this and find that our main conclusions concerning the effect of bullying on outcomes prevail. Again, these results are available on request.

## **VII. Conclusion**

This paper investigates the effects of being bullied *and* of bullying others in elementary school on longer-run education, health and risky behavior. We employ a number of strategies in order to come closer to identifying a causal impact of such experiences than previous research. We first combine our rich conditioning set with mother fixed effects. Second, we incorporate classroom and school fixed effects. Third, we account for detailed measures of ability and behavior measured just prior to exposure to bullying. For a subset of the children in our sample we also have access to this type of information measured at age 3.5. Fourth, we follow Altonji, Elder, and Taber (2005) and use selection on observable variables to assess the likelihood that our estimates are driven by selection on unobservables. Finally, we perform a falsification test using adult height as outcome, in the spirit of Havnes and Mogstad (2011).



We find that being bullied *and* bullying reduces GPA by around 20% of a S.D., which is comparable to the effect of having 7 more pupils in the class. Being a victim of bullying also increases future use of psychopharmacological medication, body weight (boys) and the probability of teenage pregnancy (girls), while being a perpetrator leads to a higher probability of future criminal convictions. Besides the direct effect bullying has on the child in the longer run, we show that an additional mechanism may arise through teacher perceptions of short-run abilities and behavior.

Given that bullying seems to be so costly for all parts involved, can it be limited? Farrington and Ttofi (2009) systematically review evaluations of 44 school-based anti-bullying programs. They find that the reviewed interventions on average reduce the prevalence of bullying and victimization by roughly 20%. Program effectiveness increases with inclusion of more elements, longer duration and higher intensity. Some of the single elements that are significantly related to successful intervention are teacher and parent training as well as use of disciplinary methods and video and virtual reality video games. Furthermore, programs inspired by the pioneer, Olweus, are found to be more effective than others.

The details of the *Olweus bullying prevention program* are described in Olweus (1997). The idea is to combine warmth and positive involvement from adults with firm limits to unacceptable behavior. Violation of the limits and rules should be followed by non-hostile, non-physical sanctions. The program implicitly requires some monitoring of behavior as well as adults acting as authorities at least in some respects. This relatively simple skeleton underlies bullying prevention programs implemented all over the world. Yet bullying prevails. Of course, such intensive programs are likely expensive and rely at least partly on very specific – and possibly limited – human resources. However, our results indicate that such programs may have longer run aggregate effects in improving education, health and

risky behavior of the population because effects of being bullied and bullying on individual outcomes are large.

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## **Appendix A Attrition**

10,907 children were initially included in the ABC survey. Unfortunately, not all parents and teachers reported in the subsequent survey rounds. This has consequences for our measures of whether the child is exposed to or engages in bullying. It also implies that we have incomplete information about our short-run outcome measures. Since our long-run outcomes stem from registers, we do not face this problem in our long-run analyses.

62 % of the parents and 52 % of the teachers respond to the bullying question in the 2002 round of the questionnaires. This gives rise to concern about possible bias due to attrition, especially because the subject being surveyed is of sensitive nature. In our estimations, we handle this by including a dummy for missing information about bullying. Because the survey is linked to register-based information, we are able to test possible differences in the populations of parents who responded and who did not respond. We find that non-respondents are more likely to have worse socio-economic background, were on average younger when the child was born, were more likely to be of ethnic minority origin, and have more psychiatric diagnoses.

## Appendix B Details about the conditioning set

**Table B1** *Detailed Description of Variables*

Variable	Description	Source
<b>Child characteristics:</b>		
Boy	Boy (0/1)	Registers
Height	Child's height in cm. measured in 2001.	2001 Questionnaire
Born in 1990	Born in 1990 (0/1)	Registers
Born in 1991	Born in 1991 (0/1)	Registers
Born in 1992	Born in 1992 (0/1)	Registers
Born prematurely (before week 37)	If the child was born before the 37 <sup>th</sup> gestational week (0/1)	Registers
Born prematurely (before week 28)	If the child was born before the 28 <sup>th</sup> gestational week (0/1)	Registers
Birth weight (g)	The child's birth weight in grams	Registers
Complications at birth	Complications at the birth of the child based on an APGAR score above 6.	Registers
# younger siblings	Number of younger siblings before the age of seven. These include half siblings	Registers
# older siblings	Number of older siblings before the age of seven. These include half siblings.	Registers
Ethnic	Non-Danish origin (0/1)	Registers
Divorce	Experienced that the birth parents split up before the age of seven (0/1)	Registers
# divorces	Number of times the mother of the child got a new partner before the child turned seven.	Registers
# moves	Number of moves between municipalities	Registers
Cardiovascular medicine	Was prescribed cardio-vascular medicine before the age of seven (0/1)	Registers
Antidepressant medicine	Was prescribed antidepressant medicine before the age of seven (0/1)	Registers
Diagnosis	Diagnosis of a mental or behavioral disorder before the age of seven (0/1)	Registers
Emergency ward 4-6	Whether the child visited the ER during age 4-6 (0/1)	Registers
Impaired Hearing	Has the child impaired hearing? (0/1)	2001 Questionnaire
Wears glasses	Does the child use glasses? (0/1)	2001 Questionnaire
Cross-eyed	Has the child been crosseyed, now or earlier? (0/1)	2001 Questionnaire
<i>Childcare at age 4:</i>		
Private care (0/1)	Enrolled in family day care (0/1)	Registers
Centerbased care (0/1)	Enrolled in centerbased care (0/1)	Registers
Home care (0/1)	Taken care of by parents or grandparents at home (0/1)	Registers

**Table B1 (Continued)**

Variable	Description	Source
<b>Father's and mother's characteristics:</b>		
Age at birth of child	The mothers age when she gave birth to the child	Registers
Smoked (only mother)	Smoked during pregnancy (0/1)	Registers
Log income	Log wage income when the child was 6 years old	Registers
Unemployment (4 yrs.)	Part of year unemployed when the child was four years old. Equal to 1000 if unemployed the entire year.	Registers
Unemployment (5 yrs.)	Part of year unemployed when the child was five years old. Equal to 1000 if unemployed the entire year.	Registers
Unemployment (6 yrs.)	Part of year unemployed when the child was six years old. Equal to 1000 if unemployed the entire year.	Registers
Top management level	Employed at a top management level when the child was six years old (0/1)	Registers
Higher management level	Employed at a higher management level when the child was six years old (0/1)	Registers
Medium level employee	Employed at a medium level when the child was six years old (0/1)	Registers
Lower level employee	Employed at a lower level when the child was six years old (0/1)	Registers
Full time employment	Is full time employed (more than 25 hours/week) (0/1)	Registers
Part time employment	Is part time employed (less than 25 hours/week) (0/1)	Registers
Private sector	Works in the private sector (vs. The public sector) (0/1)	Registers
<i>Highest completed education when the child was six years old:</i>		Registers
Elementary school	Elementary school. Equivalent to 9 years of education (0/1)	Registers
High school	High School. Equivalent to 12 years of education (0/1)	Registers
Vocational degree	Vocational degree. Equivalent to 12 years of education (0/1)	Registers
Short further education	Short further edu.: Equivalent to 14 years of education (0/1)	Registers
Medium further education	Medium further edu.: Equivalent to 15 years of education (0/1)	Registers
Long further education	Long further edu.: Equivalent to 17 years of education or more (0/1)	Registers
Enrolled in education	Enrolled in education when the child was 6 years old (0/1)	Registers
Cardiovascular medicine	Was prescribed cardio-vascular medicine before the child was six years old (0/1)	Registers
Cardiovascular medicine	Was prescribed antidepressant medicine before the child was six years old (0/1)	Registers
Diagnosis of mental or behavioral disorder	Was diagnosed with a mental or behavioral disorder before the child was six years old (0/1)	Registers
Violence conviction (0/1)	Has been convicted of a violence crime before the child was six years old.	Registers
Property conviction (0/1)	Has been convicted of a property crime before the child was six years old.	Registers
Special Conviction (0/1)	Has been convicted of a crime under the special law before the child was six years old.	Registers
Other Crime Conviction (0/1)	Has been convicted of a penal crime which was not violence or property before the child was six years old.	Registers
Traffic Conviction (0/1)	Has been convicted of a traffic offence before the child was six years old.	Registers
Prison sentence (0/1)	Has been sentenced to prison before the child was six years old.	Registers