

RESEARCH ARTICLE

Adolescent boys' physical fighting and adult life outcomes: Examining the interplay with intelligence

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Abstract

Although it is well known that adolescent delinquent behavior is related to poor outcomes in adulthood, longitudinal research on specific acts of delinquency and their interplay with important individual characteristics in predicting future outcomes is scarce. We aimed to examine how physical fighting—one of the most common acts of violent delinquency among adolescent boys—is related to adult life success in several domains, and how intelligence influences these associations. The study used data from 1,083 boys that participated in the population-based longitudinal Young in Norway Study, following adolescents from 1992 to 2015, by combining self-reports at four time points with comprehensive information from registers. Results showed that adolescent boys' physical fighting was associated with poor adult outcomes in the domains of employment, education, and criminal behavior. Associations remained significant even after controlling for conduct problems in general—which isolated the effects of fighting from other delinquent acts—as well as from a variety of other potential confounders. Detailed analyses on the interplay of physical fighting and intelligence showed that some parts of the associations between adolescent boys' fighting and several adverse adult outcomes could be ascribed to lower intelligence among the fighters. Moreover, intelligence moderated the relationship between physical fighting and adult education. Adolescent fighting was not related to educational attainment among boys with high intelligence, whereas boys with lower intelligence experienced detrimental effects of adolescent fighting. The analyses show the importance of considering adolescent boys' physical fighting as a potential risk factor for future social marginalization.

KEYWORDS

adolescent, intelligence, juvenile delinquency, social marginalization, violence

1 | INTRODUCTION

A substantial amount of research links both adolescent delinquency (Bernburg & Krohn, 2003; Lanctôt, Cernkovich, & Giordano, 2007; Makarios, Cullen, & Piquero, 2017) and violent behavior (Kim, 2018; Tanner, Davies, & O'Grady, 1999; Wilczak, 2014) to adverse outcomes in adult life. Specific acts of delinquency may differ in

their associations with future life outcomes. However, detailed knowledge of such relationships is limited. In particular, we know little about the long-term effects of physical fighting—a common act of violent delinquency among adolescent boys (Pickett et al., 2013). Physical fighting rarely results in any formal sanctions, and some adolescents even consider fighting an appropriate conflict-resolution tactic (Shetgiri, Lee, Tillitski, Wilson, & Flores, 2015), which points to

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the importance of studying the long-term outcomes of engaging in this behavior.

Research has suggested that individual differences in cognitive abilities influence the outcomes of adolescent delinquency (Makarios et al., 2017). Cognitive abilities are also one of the most consistent predictors of adult life success in employment and education, even after taking adolescent delinquency into account (Tanner et al., 1999). However, there is a lack of studies that specifically consider the interplay of cognitive abilities and violent delinquency in affecting important life outcomes and no studies have examined physical fighting in this respect. A more thorough understanding of the complex interplay between physical fighting and cognitive abilities is essential for designing tailored interventions for youth with behavioral problems.

This study is the first to examine the long-term association between adolescent boys' physical fighting and important adult life outcomes. To investigate the association, we use data from a large-scale longitudinal study following adolescent boys in Norway over a period of more than 20 years by means of questionnaires, as well as data from official education, employment, and crime registers. Furthermore, by utilizing test results from the National Conscript Service we provide new knowledge of how intelligence contributes to variations in the long-term outcomes of physical fighting in adolescent boys.

1.1 | Adolescent violence and later life outcomes

A number of studies have linked adolescent delinquency to negative outcomes in adult life (e.g., Bernburg & Krohn, 2003; Lanctôt et al., 2007; Makarios et al., 2017). Two diverging theoretical accounts have been proposed for understanding this relationship, even though studies testing the explanations in relation to violent delinquency, in particular, are scarce (for an exception, see Kim, 2018). The first account views individual differences in personal characteristics as the prime explanatory factor of the association between adolescent delinquency and adult outcomes (e.g., Gottfredson & Hirschi, 1990). Specifically, it proposes that individual risk factors for both delinquency and life outcomes—such as disadvantageous personality traits, low self-control, or low intelligence—are the underlying reason for the association between these concepts. In other words, this perspective considers the relationship between adolescent delinquency and adult outcomes to be spurious, thereby implying that the association will diminish when accounting for individual differences in risk factors. In contrast, the second theoretical account—frequently referred to as the life-course theory of cumulative disadvantage—postulates that adolescent delinquency in itself has a direct, and possibly causal, influence on adult life outcomes (e.g., Moffitt, Caspi, Harrington, & Milne, 2002; Sampson & Laub, 1997). Specifically, it proposes that adolescents who perpetrate delinquent acts are stigmatized and excluded. These reactions by society, in turn, impede individuals' pathways to successful adult life. Moreover, limited options for a successful normal life may intensify a delinquent lifestyle and result in more socialization with other delinquents, thereby reinforcing processes of delinquency

and marginalization. Previous research has termed these processes “labeling,” “stigmatization,” and “snaring” (Bernburg & Krohn, 2003; Moffitt et al., 2002).

Both theoretical accounts have received empirical support. In accordance with Gottfredson and Hirschi's (1990) assumptions, individual differences in self-control (Gottfredson & Hirschi, 1990) and cognitive abilities (Tanner et al., 1999) have been identified as confounding factors in the relationship between adolescent delinquency and life success in adulthood. Similarly, controlling for both observed and unobserved family factors by using family fixed effects models substantially reduced the observed relationship between violent delinquency and educational outcomes (Kim, 2018). Conversely, studies also show how labeling through criminal justice involvement during adolescence impedes later life opportunities (e.g., Bernburg & Krohn, 2003; Lopes et al., 2012). Wertz et al. (2018) included factors related to both of the theoretical accounts in combined analyses and found that severe childhood conduct problems contributed to an increased risk of adult life failure even when accounting for genetic and environmental familial risk and concurrent adult psychopathology. However, including familial risk factors in the analyses reduced the impact of childhood conduct problems, thereby supporting both theoretical accounts. Other empirical studies have drawn similar conclusions (Makarios et al., 2017; Piquero, Farrington, Nagin, & Moffitt, 2010).

Even though there is evidence supporting both theoretical accounts, the mechanisms at play may vary for different delinquent acts. For example, in Tanner et al.'s (1999) study, school truancy was negatively related to a variety of future educational outcomes also after accounting for other types of delinquent behavior, even though the severity of the act is negligible. Similarly, the association between contact with the criminal justice system during the adolescent years and most outcomes has been shown to be stronger than the associations for other forms of delinquency (Tanner et al., 1999). Researchers have also found violent and nonviolent delinquency to differ in their associations with educational outcomes (Kim, 2018). Therefore, more knowledge about how separate domains of delinquency influence adult outcomes is important for an increased understanding of the mechanisms at play in these relationships. This might be particularly relevant for a behavior such as physical fighting, which is quite common among adolescent boys and in addition often remains unsanctioned.

Only three studies have so far considered the specific association between violent delinquency and adult life outcomes. Tanner et al. (1999) found that boys' delinquency during adolescence significantly predicted a range of educational and employment outcomes in young adulthood, such as educational attainment, unemployment, and job status. However, when including several relevant confounders in the analyses, such as sociodemographic characteristics, cognitive abilities, and educational expectations, violent delinquency no longer showed significant associations with earning a high school diploma and occupational status, and associations with other outcomes were significantly weakened. When additionally adjusting for other forms of delinquent behavior, such as contact with the criminal justice system, drug use, and property crime, violent delinquency was no longer related to any of the outcomes. Similar results were obtained by Kim (2018). The study initially identified a

consistent association between violent delinquency and educational outcomes among adolescent boys and girls; however, when analyzing sibling pairs in family fixed effects models, and thereby accounting for both measured and unmeasured environmental influences, close to all of the associations between violent delinquency and educational outcomes disappeared. Finally, Wilczak (2014) also identified a significant relationship between violent perpetration among boys and girls during high school and educational success in young adulthood. The relationship remained significant after controlling for a variety of factors such as violent victimization in both adolescence and young adulthood, violent perpetration in young adulthood, socioeconomic factors, neighborhood characteristics, and self-control. The study did not control for cognitive abilities and other forms of adolescent delinquency, however.

Thus, the available studies reach somewhat different conclusions regarding the associations between violent delinquency and adult life outcomes. Whereas all studies found an initial association between violent delinquency and later life outcomes, some were able to account for the relationship by including relevant control variables in the analyses but others were not. One important consideration is whether it is appropriate to account for other forms of conduct problems in the analyses. Controlling for conduct problems strengthens the possibility of identifying negative outcomes of violent delinquency that are not caused by attributes related to a delinquent lifestyle in general (Gottfredson & Hirschi, 1990). Previous research also points to other important confounding factors when considering potential mechanisms for understanding the relationship between violent delinquency and adult life outcomes, such as cognitive abilities, family background, and social relationships.

1.2 | The interplay between delinquency and intelligence

As suggested by Tanner et al. (1999), cognitive abilities might be an important confounder of the relationship between adolescent delinquency and adult life outcomes. If this is true, some parts of the observed association between delinquent behavior and adult outcomes are the result of initial differences in cognitive abilities and statistically controlling for cognitive abilities should reduce the observed associations. In line with this suggestion, previous research has linked low intelligence to boys' physical fighting (Loeber, Green, Lahey, & Kalb, 2000) and more generally to the perpetration of violence for both genders (Jacob, Haro, & Koyanagi, 2019). Possible explanations of the observed association are intelligence-related deficits in personal and social competencies, such as communication skills (Crick & Dodge, 1994) and self-control (Gottfredson & Hirschi, 1990); these deficits, in turn, may elicit aggressive and violent behavior.

The association between intelligence and adult life outcomes is also well established in previous research. In a meta-analytic review, Strenze (2007) analyzed the longitudinal relationship between intelligence in childhood and adolescence and socioeconomic success in adult life. Intelligence was strongly related to education when measured by years of obtained education ($r = .56$; 59 data sets, $N = 84,828$). Moreover, intelligence was associated with occupational level, typically measured

by instruments assessing the desirability and prestige of different occupations, with an overall correlation of $r = .43$ (45 data sets, $N = 72,290$). Finally, intelligence correlated $r = .20$ with income, measured by salary or total monetary income (31 data sets, $N = 58,758$). Thus, research consistently shows intelligence to be prospectively related to future academic, occupational, and financial success. Recent research additionally indicates that the association between education and intelligence might be reciprocal, as a large meta-analysis of quasi-experimental studies estimating the causal effect of education on intelligence have shown that each additional year of education was related to an increase of 1–5 IQ points (Ritchie & Tucker-Drob, 2018). Evidence from prospective longitudinal studies also shows that high intelligence protects against future violent behavior, violent crimes, and criminal offending in general (Barker et al., 2007; Schwartz et al., 2015; Ttofi et al., 2016). These empirical findings indicate that cognitive abilities may influence both physical fighting and future adult life outcomes and may, therefore, function as a confounder inducing a spurious relationship between adolescent boys' fighting and adult life outcomes. However, the degree to which cognitive abilities act as a confounder of this relationship has not been tested directly up to now.

Cognitive abilities may also influence the relationship between delinquency and future outcomes in other complex ways. For example, adolescents with higher intelligence may use violence in a more instrumental manner than adolescents with lower intelligence do, or they may be better at avoiding negative consequences of fighting from their environment. Hence, people with higher intelligence might act in ways that make them resilient to the long-term consequences of adolescent violence. In other words, intelligence may function as a moderator, where the relationship between adolescent fighting and important life outcomes would be weaker for adolescents with high intelligence than for adolescents with lower intelligence. Empirical studies investigating such potential moderating effects of intelligence on violent delinquency in relation to future later life outcomes are lacking. However, in related research, Makarios et al. (2017) found a moderating effect of vocational aptitude—a test of cognitive abilities—on adolescent delinquency concerning some adult outcomes. The analyses showed that the association between adolescent delinquency and both graduation from high school and adolescent pregnancy was stronger among those with low vocational aptitude. Yet, no moderation of vocational aptitude was identified for enrolling in college, labor market marginalization, and two measures of sexual risk behavior.

In the present study, we consider intelligence as both a potential confounder and a moderator in the relationship between adolescent boys' physical fighting and adult life outcomes.

1.3 | Gender differences in physical violence

Violence, and particularly serious physical violence, tends to be classified as a typical male behavior (Baxendale, Cross, & Johnston, 2012) and empirical studies have found approximately twice the rate of physical fighting in boys compared to girls (Kann et al., 2018). Violent behavior among women has also been considered

incompatible with society's cultural stereotypes for feminine behavior (Gilbert, 2002). Given that physical violence is less prevalent among girls and a less normative act than fighting among boys, one might hypothesize that the long-term negative outcomes of physical violence perpetration might be more profound for girls than for boys. However, Tanner et al. (1999) showed that the negative effects of violent delinquency on educational and occupational outcomes did not differ across gender or even were smaller for girls than boys for some outcomes. Other studies including both boys and girls have not examined whether long-term outcomes of adolescent violence differed across gender (e.g., Kim, 2018; Wilczak, 2014) and research on this issue is thus sparse. The present study investigates long-term outcomes of boys' physical fighting only and future research should address if such findings can be generalized to girls as well.

1.4 | The present study

In summary, research on the relationship between adolescent physical fighting—one of the most common acts of violent delinquency among adolescent boys—and adult life outcomes is scarce and studies on the complex interplay between physical fighting and intelligence are lacking. The present study addresses this study gap. Specifically, the aim of the study was to investigate how adolescent boys' physical fighting was related to adult life outcomes in several domains, such as employment, education, and crime, and to explore the interplay between physical fighting and intelligence in the observed relationships. For this purpose, we analyze survey data from a sample of 1,083 boys from a longitudinal study of Norwegian adolescents followed over a 13-year period from 1992 to 2015, with linkage to data on life outcomes from official registers up to 2015 (when the participants' mean age was 38) and to intelligence test data from the Norwegian National Conscript Service. Based on previous research on the associations between adolescent boys' delinquency and life outcomes, we expect that physical fighting would be related to adverse adult life outcomes in employment, education, and crime. Moreover, we expect that some of the associations between physical fighting and adult life outcomes would be accounted for by confounders such as intelligence, other forms of delinquent behavior, family background, and delinquent peer relations. We will scrutinize in detail the confounding effects of intelligence by means of formal confounder analyses, and we expect that individual differences in intelligence would explain some of the negative outcomes of adolescent boys' physical fighting. Finally, we expect that the negative associations between physical fighting in adolescence and adult life success are moderated by intelligence.

2 | METHODS

2.1 | Procedure and participants

The present study used questionnaire data from the *Young in Norway Study*, collected at four-time points: 1992 (T1), 1994 (T2), 1999 (T3),

and 2005 (T4) (see von Soest, Wichstrøm, & Kvalem, 2016). These data were linked to time series data from official registers and to intelligence test data from the Norwegian National Conscript Service. The study initially included a nationally representative sample of students in junior and senior high school (age 13–18), with 12,287 participants and a response rate of 97%. At T2, students who still attended the same school as at T1 were followed up with questionnaires at school. A sizable portion of the students had completed their 3-year track at the junior or senior high school that they attended at T1, and received the T2 questionnaire by mail. The response rate of those still attending the same school at T2 was 92%, while the response rate among those who received the questionnaires by mail was significantly lower. Only students who completed the questionnaire at school at T2 ($n = 3,844$) were followed up at T3 and T4. The study was originally planned to be a two-wave study, so new informed consent had to be obtained at T2. Those then consenting ($n = 3,507$; 91%) received questionnaires by mail at T3 and T4, with data received from 2,924 (84%) and 2,890 (82%) participants, respectively. At T4, the respondents were asked for their consent to link the data to several registers, to which 2,606 respondents (90%) agreed, of whom 1,147 were boys. The overall participation rate of the final sample, based on all eligible students at T1 who still were at their original school at T2, was, therefore, 68% at T3, 67% at T4, and 60% concerning the assessment of register data.

Intelligence test scores were available only for boys, thereby restricting the sample included in the present study to boys who had valid intelligence test scores and consented to linking of the data to official registers. Sixty-two boys were excluded due to missing intelligence test scores, and two boys withdrew their consent to data linkage, leaving a total sample of 1,083 boys. All participants agreed to participate both orally and in writing, and the parents of participants younger than 16 years at T1 also consented to their children's participation in the survey. The Norwegian Data Inspectorate and the Regional Committee for Medical Research Ethics approved the study. The procedures have been thoroughly presented in previous publications (von Soest et al., 2016).

Attrition was examined by means of bivariate logistic regression analyses. Results showed that older age (odds ratio [OR] = 1.36; $p < .01$), higher levels of conduct problems in both the respondents (OR = 1.17; $p = .03$) and the respondents' friends (OR = 1.07; $p < .01$), and having a migration background (OR = 3.68; $p < .01$) were related to attrition. Attrition was not related to physical fighting. Attrition analyses could not be conducted for variables assessed by means of register data (i.e., intelligence and outcome variables) because the data set only contained register data for those responding at T4, and not the entire initial sample.

2.2 | Measures

2.2.1 | Physical fighting

Physical fighting was assessed at T2 by two items about the frequency of physical fighting during the previous 12 months. One question asked about physical fighting where respondents had used a

weapon, and a separate question asked about fighting where no weapons were used, with response options *0 times*, *1 time*, *2–5 times*, *6–10 times*, *10–50 times*, and *more than 50 times*. Responses were categorized as follows: no instances of either kind of behavior (0), only one instance of physical fighting, either with or without a weapon (1), or at least two instances of physical fighting when combining the two items (2). In the moderation and confounder analyses, the variable was dichotomized into no fighting the previous 12 months and at least one fight.

2.2.2 | Intelligence

Intelligence test scores were obtained from the Norwegian National Conscript Service. At the time of the study, it was mandatory for all male Norwegian citizens to be evaluated for ability to serve in the military. Enrollment in military service began with a meeting with a conscript board as well as both physical and psychological evaluations, including an intelligence test. About 90% of all men liable for military service attend the meeting (Sundet, Eriksen, Borren, & Tambs, 2010). The intelligence score is generated as a composite score of three different tests, Arithmetic (30 items), Word Similarities (54 items), and Figures (36 items). The Arithmetic test aims to measure arithmetic and algebraic ability, as well as logical reasoning, and is comparable to the Arithmetic test in the Wechsler Adult Intelligence Scale (WAIS). The Word Similarities test is a synonym test, comparable to the Vocabulary test in WAIS. Finally, the Figures test aims to measure abstract and nonverbal reasoning and is comparable to Raven's Progressive Matrices. The intelligence test used by the Norwegian National Conscript Service is highly correlated with WAIS IQ (Sundet, Tambs, Magnus, & Berg, 1988) and has been used extensively in previous publications (see e.g., Sundet et al., 2010). Scores on the test are presented in stanine units. A stanine score of 5 represents the mean intelligence test score in the population, with a standard deviation (*SD*) of 2.

2.2.3 | Adult life outcomes

The highest completed education level in 2015 was assessed based on register data. For the education level attained, respondents were categorized as: not having education after junior high school (1), having 1–2 years of education in senior high school (2), having completed senior high school (3), having 1–3 years of higher education (4), or having 4 or more years of higher education (5). Concerning employment, we assessed the respondents' average income in the years 2012–2014 by means of register data. The variable was categorized into 10 deciles, to account for skewness in the distribution of income. Moreover, by using register data, we constructed an indicator of labor marked marginalization, showing whether the respondents had received social security or disability benefits or participated in work assessment or work rehabilitation in the period 2012–2014. Finally, two outcomes of criminal involvement were included. Based on register data, a dummy variable indicated whether the respondents had been charged at least once

for a criminal offense in the period 1996–2014. Another dummy variable contrasted charges for violent crimes with not having been charged for any crime or having been charged only for nonviolent crimes. We restricted assessing charges to 1996 and later, so as not to include criminal activity that had occurred before the respondents answered the questions about physical fighting in 1994.

2.2.4 | Confounders

Several variables were included in the analyses as additional confounders of the relationship between adolescent boys' physical fighting, intelligence, and later life outcomes. First, register data were used to measure the highest level of education attained by parents when the respondent was 16 years old, ranging from 1 (junior high school or lower education) to 4 (higher university degree). Second, respondents' conduct problems at T2 were assessed by a 15-item instrument ($\alpha = .76$) based on the DSM-III-R criteria for conduct disorder. The instrument assessed the frequency of participants' conduct problems during the previous 12 months on a 6-point scale, ranging from *never* to *more than 50 times*. Items ranged from rather common behavior, such as school truancy, to more serious behaviors, such as stealing and vandalism. Third, the respondent's two best friends engaging in four different kinds of problematic conduct in the last 12 months was assessed at T2; smoking cigarettes, alcohol use at least weekly, smoking cannabis, and being involved with the police. The variable was generated as a sum of numbers of yes on the four questions, ranging from 0 to 8 ($\alpha = .76$). Fourth, age was assessed by means of data from official registers. Finally, migration background was defined by having two foreign-born parents.

2.3 | Statistical analyses

All life outcomes were included as dependent variables in separate regression analyses, with physical fighting and intelligence as the main independent variables. Logistic regression analyses were used for dichotomous outcomes and linear regression analyses for continuous outcomes. The regression analyses were conducted in several steps. In the first model, two dummy variables measuring physical fighting were included as predictors together with age and migration background as control variables. In a second model, intelligence was added as a predictor. The third model included parental education and the respondent's and respondent's friends' conduct problems as additional covariates. In the next set of analyses, the confounding effects of intelligence in the relationship between physical fighting and life outcomes were assessed by tests comparable to mediation analyses. As suggested by MacKinnon, Krull, and Lockwood (2000), confounder effects were assessed by means of the product of coefficients approach in a path-analytic framework, and bias-corrected standard errors were obtained based on 5,000 bootstrap samples (Hayes, 2018). Finally, interaction terms between intelligence and the dichotomous instrument measuring physical fighting were assessed to examine possible moderating effects of intelligence in the relationship between physical fighting

and life outcomes. Significant moderation effects were further probed by using the Johnson-Neyman technique of regions of significance (Johnson & Neyman, 1936), as well as simple slope analyses of conditional effects estimated based on results from the moderation analyses (Hayes, 2018).

All analyses except model diagnostics for the logistic models were conducted using the statistical package Mplus Version 7.4. Missing data were handled by the full information maximum likelihood procedure, thereby providing missing data routines that are considered to be state of the art (Schafer & Graham, 2002). Nagelkerke R^2 and Hosmer-Lemeshow goodness-of-fit in logistic regression models were estimated using IBM SPSS Statistics 25 where missing data were handled by a listwise deletion procedure.

3 | RESULTS

3.1 | Descriptive statistics

Of the participating boys, 66.1% reported not having been involved in physical fighting the previous year. Of the remaining boys, 16.5% had been involved in one fight, and 17.4% had been involved in two or more fights. As Table 1 shows, reporting at least one instance of physical fighting correlated -0.18 ($p < .001$) with intelligence, indicating that boys with higher intelligence engaged in physical fighting less often than boys with lower intelligence. Both physical fighting and intelligence were correlated with all included life outcomes ($p < .05$). Of the potential confounders, parental education

correlated negatively with physical fighting and all but one of the adverse outcomes and correlated positively with intelligence and all positive outcomes ($p < .01$). The respondent's conduct problems correlated in the opposite direction with the same variables ($p < .05$), while the respondent's friends' conduct problems correlated similarly with all measures except labor market marginalization.

3.2 | The relationship between adolescent boys' physical fighting and life outcomes

The relationships between adolescent boys' physical fighting and later life outcomes were assessed by means of regression analyses. In the first set of analyses, life outcomes were regressed on two dummy variables contrasting no fighting with one instance and more than once instance of physical fighting the previous year, respectively. No fighting was the reference category, and age and migration background were included as covariates. As Model 1 in Table 2 and 3 shows, adolescent boys' physical fighting was related to all the measured adverse outcomes in adult life: charges for both violent crimes and crimes overall, labor market marginalization, education, and income. Boys' fighting was in particular strongly related to being charged with a violent crime, as the odds for such charges were more than five times as high when comparing boys with no involvement in fighting to those who had experienced one or more episodes of fighting. Moreover, being involved in several fights the previous year entailed particularly detrimental effects for later life success in all measured outcomes. In Model 2 of Tables 2 and 3, intelligence was

TABLE 1 Descriptive statistics and correlations between study variables ($n = 1,083$)

	M (SD) or %	Correlations												
		1	2	3	4	5	6	7	8	9	10	11		
1. At least one instance of physical fighting	33.9													
2. Intelligence (1-9)	5.83 (1.64)	-.18***												
3. Any criminal charges 1996-2014 (yes)	20.8	.16***	-.19***											
4. Charged with violent crime 1996-2014 (yes)	3.5	.16***	-.12***	.37***										
5. Education level in 2015 (1-5)	3.59 (1.08)	-.23***	.38***	-.25***	-.16***									
6. Average income 2012-2014 (10 deciles)	5.5 (2.87)	-.07*	.19***	-.09**	-.12***	.33***								
7. Labor market marginalization 2012-2014 (yes)	3.8	.13***	-.13***	.14***	.20***	-.23***	-.29***							
8. Parental education (1-4)	2.51 (0.82)	-.18***	.29***	-.09**	-.09**	.30***	.14***	-.05						
9. Conduct problems T2 (1-6)	1.46 (0.45)	.38***	-.11***	.15***	.09**	-.26***	-.18***	.14***	.13***					
10. Friends' conduct problems T2 (0-8)	1.21 (1.69)	.18***	-.07*	.14***	.13***	-.17***	-.07*	.04	-.05	.46***				
11. Age	15.2 (1.95)	-.20***	.06	-.01	-.02	.02	.06*	.03	-.01	-.01	.20***			
12. Migration background (yes)	1.2	.04	-.03	-.01	.08**	.01	-.02	-.02	-.02	-.02	-.02	-.02	.03	

* $p < .05$.

** $p < .01$.

*** $p < .001$.

TABLE 2 Logistic regression analyses of life outcomes with physical fighting and intelligence as explanatory variables ($n = 1,083$)

	Any criminal charge OR [95% CI]	Violent crime OR [95% CI]	Labor market marginalization OR [95% CI]
Model 1			
No physical fighting (ref.)			
Once instance of fighting	1.89 [1.24; 2.85]**	5.60 [2.19; 15.07]***	4.05 [1.70; 9.29]**
Two or more instances of fighting	2.72 [1.81; 3.99]***	5.69 [2.18; 15.13]***	5.09 [2.19; 12.06]***
Nagelkerke R^2	.04	.10	.08
Hosmer-Lemeshow goodness-of-fit, p	.88	.79	.39
Model 2			
No physical fighting (ref.)			
Once instance of fighting	1.74 [1.13; 2.61]*	4.97 [1.82; 12.92]**	3.66 [1.49; 8.41]**
Two or more instances of fighting	2.28 [1.49; 3.40]***	4.59 [1.71; 12.76]**	3.98 [1.72; 9.13]**
Intelligence (1–9)	0.77 [0.69; 0.84]***	0.73 [0.60; 0.88]**	0.70 [0.57; 0.85]***
Nagelkerke R^2	.09	.14	.11
Hosmer-Lemeshow goodness-of-fit, p	.57	.79	.35
Model 3			
No physical fighting (ref.)			
Once instance of fighting	1.53 [0.97; 2.34]	4.28 [1.56; 10.89]**	3.51 [1.48; 7.88]**
Two or more instances of fighting	1.66 [1.03; 2.61]*	3.33 [1.20; 9.49]*	3.10 [1.14; 8.16]*
Intelligence (1–9)	0.78 [0.70; 0.86]***	0.76 [0.63; 0.93]**	0.70 [0.57; 0.87]**
Parental education (1–4)	0.95 [0.77; 1.16]	0.74 [0.47; 1.13]	1.10 [0.69; 1.73]
Conduct problems T2 (1–6)	1.32 [0.85; 2.02]	0.71 [0.31; 1.43]	2.17 [0.99; 4.28]
Friends' conduct problems T2 (0–8)	1.12 [1.01; 1.25]*	1.36 [1.04; 1.70]*	0.89 [0.67; 1.10]
Nagelkerke R^2	.10	.19	.12
Hosmer-Lemeshow goodness-of-fit, p	.94	.37	.34

Note: Age (centered) and migration background were included as control variables. Nagelkerke R^2 and Hosmer-Lemeshow goodness-of-fit were calculated in IBM SPSS Statistics 25, handling missing data by a listwise deletion procedure.

Abbreviations: 95% CI, 95% confidence interval of OR; OR, odds ratio.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

included as an additional covariate. The results showed high intelligence to be related to a higher degree of life success for all adult outcomes. Including intelligence in the model also reduced the coefficients for physical fighting. In Model 3, parental education and both the respondent's and respondent's friends' conduct problems were included as additional confounders. After including confounders, the relationship between boys' physical fighting and all outcomes except income remained statistically significant. Concerning educational attainment and being charged with a crime, only participation in two or more fights the previous year remained significantly related to the outcomes.

3.3 | The interplay between adolescent boys' physical fighting and intelligence

Confounder effects of intelligence in the relationship between adolescent boys' physical fighting and adult outcomes were analyzed using the product of coefficients approach. Physical fighting was included as a dichotomous variable in the analyses, and age, migration background, parental education, and the respondent's and respondent's friends' conduct problems were added as confounders. For two of the five outcomes, intelligence was a significant confounder in the relationship

between adolescent boys' physical fighting and adult outcomes. Regarding violent crime, the confounder effect of intelligence was estimated to -0.04 ($p = .030$; 95% CI $[-0.08; -0.01]$). This is equal to 11.6% of the total estimated effect. Labor market marginalization showed a similar coefficient, with a confounder effect of -0.03 ($p = .027$; 95% CI $[-0.07; -0.01]$), equaling to 8.1% of the total estimated effect. Hence, individual differences in intelligence accounted for some part of the negative association of boys' physical fighting with adult life outcomes. Intelligence was not a significant confounder for being charged with a crime (confounder effect = -0.01 ; $p = .053$; 95% CI $[-0.03; 0.00]$), education level (0.00; $p = .073$; 95% CI $[0.00; 0.01]$), and income (-0.01 ; $p = .190$; 95% CI $[-0.02; 0.00]$).

In a final step, we investigated whether individual differences in intelligence moderated the long-term outcomes of adolescent boys' physical fighting by estimating regression analyses where interaction terms between intelligence and the dichotomous physical fighting variable were additionally added (analyses not shown in tables). The interaction term reached significance only with education level as an outcome ($p = .031$). Figure 1 provides a graphical representation of the interaction effect by depicting the estimated relation between adolescent boys' physical fighting and the respondents' highest attained education level in 2015 for five groups; boys with an

TABLE 3 Linear regression analyses of life outcomes with physical fighting and intelligence as explanatory variables ($n = 1,083$)

	Education level attained (1–5)		Average income (10 deciles)	
	<i>b</i> [95% CI]	β	<i>b</i> [95% CI]	β
Model 1				
No physical fighting (ref.)				
Once instance of fighting	-0.36 [-0.54; -0.18]***	-0.12	0.03 [-0.50; 0.51]	0.00
Two or more instances of fighting	-0.71 [-0.90; -0.52]***	-0.25	-0.67 [-1.16; -0.19]**	-0.09
<i>R</i> ²	.06			
Model 2				
No physical fighting (ref.)				
Once instance of fighting	-0.27 [-0.44; -0.11]**	-0.09	0.15 [-0.37; 0.64]	0.02
Two or more instances of fighting	-0.53 [-0.72; -0.36]***	-0.19	-0.43 [-0.91; 0.05]	-0.06
Intelligence (1–9)	0.23 [0.19; 0.26]***	0.34	0.31 [0.20; 0.41]***	0.18
<i>R</i> ²	.18		.04	
Model 3				
No physical fighting (ref.)				
Once instance of fighting	-0.12 [-0.29; 0.04]	-0.04	0.42 [-0.10; 0.90]	0.06
Two or more instances of fighting	-0.24 [-0.44; -0.04]*	-0.08	0.20 [-0.33; 0.73]	0.03
Intelligence (1–9)	0.19 [0.15; 0.23]***	0.29	0.26 [0.15; 0.36]***	0.15
Parental education (1–4)	0.24 [0.16; 0.31]***	0.18	0.31 [0.09; 0.53]**	0.09
Conduct problems T2 (1–6)	-0.35 [-0.53; -0.18]***	-0.14	-1.07 [-1.53; -0.64]***	-0.17
Friends' conduct problems T2 (0–8)	-0.04 [-0.08; 0.00]	-0.06	-0.01 [-0.13; 0.12]	-0.01
<i>R</i> ²	.23		.07	

Note: Age (centered) and migration background were included as control variables.

Abbreviations: 95% CI, 95% confidence interval of *b*; *b*, unstandardized regression coefficient; β , Standardized regression coefficient.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

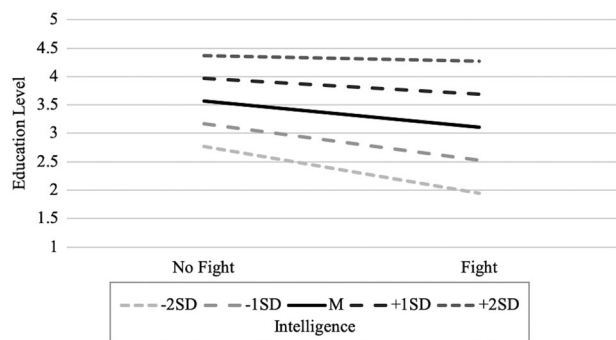


FIGURE 1 Estimated interaction between adolescent boys' physical fighting and intelligence on education level in 2015 ($n = 1,083$). The estimated slopes were generated with age and migration background as control variables. $-2SD$, intelligence $2SD$ below average (stanine score 1); $-1SD$, intelligence $1SD$ below average (stanine score 3); M , average level of intelligence (stanine score 5); $+1SD$, intelligence $1SD$ above average (stanine score 7); $+2SD$, intelligence $2SD$ above average (stanine score 9)

average intelligence level (stanine score 5), boys with an intelligence level 1 and $2SD$ below average (stanine scores of 3 and 1, respectively), and boys with an intelligence level 1 and $2SD$ above average (stanine scores of 7 and 9, respectively). As the figure shows, for boys with an intelligence level $2SD$ above the population average, the estimated regression line showed no substantial association between adolescent physical fighting and the attained education level 21 years later. Follow-up analyses by using simple slope analyses confirmed that the estimated relationship between adolescent boys' physical fighting and educational outcomes was not significant for boys with an intelligence level $2SD$ above average ($b = -0.02$; $p = .876$, 95% CI $[-0.33, 0.25]$). However, with declining intelligence levels, the association between boys' physical fighting and adverse educational outcomes increased in strength. For boys with an intelligence level $1SD$ above average, a simple slope analysis revealed a significant effect of physical fighting on education ($b = -0.23$; $p = .007$, 95% CI $[-0.40, -0.07]$), and the effect was even more profound for boys with average intelligence ($b = -0.43$; $p < .001$, 95% CI $[-0.59, -0.27]$), intelligence $1SD$ below average ($b = -0.64$; $p < .001$, 95% CI $[-0.91, -0.37]$), and intelligence $2SD$ below average ($b = -0.84$; $p < .001$, 95% CI $[-1.25, -0.41]$). Further probing of the interaction effect by means of the Johnson-Neyman technique identified the region of significance to be between 1 and 7.41 stanine units on the intelligence scale ranging from 1 to 9. Hence, adolescent physical fighting was estimated to be significantly negatively related to the adult attained education level for boys with an intelligence test score lower than 7.41 (i.e., an intelligence score $1.21SD$ above the population average).

4 | DISCUSSION

Even though previous research has shown that adolescent violent delinquency is related to adverse outcomes in adult life (e.g., Kim,

2018; Tanner et al., 1999; Wilczak, 2014), no study has explicitly considered one of the most frequent acts of violent delinquency among adolescent boys—physical fighting. This study contributes toward filling this knowledge gap and presents findings that emphasize the importance of considering physical fighting among adolescent boys as a putative risk factor of future social marginalization. The analyses showed that adolescent boys' physical fighting, and particularly repeated physical fighting, was related to adverse adult outcomes in employment, education, and crime, even after taking other forms of conduct problems into account. Moreover, the study presents new knowledge regarding the interplay of adolescent boys' physical fighting and intelligence in predicting adult life success. Individual differences in intelligence accounted for 8%–12% of the association between boys' physical fighting and adult life success for two of five included outcomes, even when controlling for relevant covariates. In addition, adolescent physical fighting had a significantly stronger negative impact on future educational success for boys with a lower intelligence level than for boys with a higher intelligence level.

4.1 | The relationship between adolescent boys' physical fighting and life outcomes

The consistent association between adolescent boys' physical fighting and adverse adult life outcomes is in line with previous studies on negative effects of both adolescent delinquency in general (Bernburg & Krohn, 2003; Lanctôt et al., 2007; Makarios et al., 2017) and violent delinquency in particular (Kim, 2018; Tanner et al., 1999; Wilczak, 2014). To account for the possibility that the observed negative effect of boys' physical fighting was just a result of a general tendency to participate in delinquent behavior, we adjusted for the occurrence of other forms of conduct problems. Conduct problems, in general, did account for some of the association between physical fighting and adult life outcomes. However, physical fighting remained significantly related to most outcomes even after this adjustment, thereby indicating that associations between adolescent boys' fighting and adult life outcomes could not be explained solely by an underlying higher level of conduct problems among the fighters. An explanation for these findings is that fighting—even though rarely formally sanctioned—may be viewed as particularly undesirable by both peers and adults alike, because the behavior may lead to physical harm of another person. As a result, adolescents involved in physical fighting may—to a greater degree than other adolescents with conduct problems—be labeled with undesirable characteristics, which in turn may lead to long-term marginalization processes over and above those elicited by general conduct problems. The remaining significant associations of adolescent boys' physical fighting with adult life outcomes even after accounting for confounders is partly in contrast to Tanner et al.'s (1999) findings, where the association between delinquent acts and adult life outcomes diminished to insignificance when adjusting for covariates. Similarly, the association between violent delinquency and educational outcomes was completely accounted for when adjusting for observed and unobserved

family characteristics by means of sibling fixed effects in another study (Kim, 2018). Our results, therefore, raise the question of whether adolescent boys' physical fighting should be conceptualized differently than other forms of delinquent behavior.

Theoretically, the analyses provide support to the notion of cumulative disadvantage, of adolescent delinquency having direct and potentially causal, effects on later life success. Even when several highly relevant control variables were included, such as cognitive abilities, parental education, and both the respondent's and respondent's friends' conduct problems, most of the associations between adolescent boys' physical fighting and life outcomes were not reduced to insignificance. However, including intelligence and other confounding variables in the analyses contributed to a reduction in the coefficient for physical fighting, indicating that other mechanisms than the direct association between fighting and adult outcomes are also at play. In addition, since confounding factors that were not assessed in the present study, such as self-control, might also confound the association between adolescent boys' physical fighting and adult outcomes, it would be premature to draw a final conclusion regarding the observed association.

4.2 | The interplay between adolescent boys' physical fighting and intelligence

In line with Tanner et al. (1999), the present study showed that intelligence was a significant confounder in the relationship between adolescent boys' physical fighting and several of the measured life outcomes. These results lend support to the notion that parts of the relationship between adolescent delinquency and adult outcomes originate from a spurious association induced by individual differences in stable individual characteristics, such as intelligence. Previous research has suggested that intelligence is related to personal or social competencies that inhibit aggressive and violent behavior (Crick & Dodge, 1994; Gottfredson & Hirschi, 1990) and may, therefore, decrease engagement in physical fighting. Further, high intelligence and the better social competencies generated by it may also be related to adult life outcomes in the educational and occupational domains, inducing the observed spurious relationship. The confounding effects retained their significance even after accounting for parental education, both the respondent's and respondent's friends' conduct problems, age, and migration background. However, the confounder effects were found for only two of the five included outcomes and were rather small (8%–12% of the total effect), thereby indicating that intelligence may be one of a multitude of confounders of the relationship between adolescent boys' physical fighting and future life outcomes.

The results of our analyses also revealed a significant moderating effect of intelligence in the relationship between physical fighting and the boys' attained education level. Among boys with higher intelligence, adolescent physical fighting did not affect their education level as adults. However, boys with lower intelligence reported fewer years of education attained if they fought during their adolescent years. The observed interaction between adolescent boys' physical fighting and intelligence concerning the attained education level is partly similar to Makarios

et al.'s (2017) findings of a significant interaction between adolescent delinquency and vocational aptitude in predicting graduation from high school. Intelligence is an important factor when it comes to the education level attained ($r = .38$), and it seems likely that high intelligence may protect boys from the negative effects of fighting through several different mechanisms. Boys with higher intelligence may be more careful in the selection of situations where they choose fighting as an appropriate act, such as when the cause seems more just or when the act is not observed by others, which again may result in both fewer immediate sanctions and less profound long-term consequences of the act. Further, high intelligence can foster resilience against the potential damaging effects of adolescent boys' physical fighting through the amount of cognitive resources available to cope adequately with the negative consequences of fighting. In short, the analyses concerning education show that compared to boys with lower intelligence, boys with higher intelligence fight more seldom, and when they do fight, their cognitive resources may enable them to mitigate the long-term consequences of their adolescent acts.

4.3 | Strengths and limitations

The present study provides evidence of a long-term association between adolescent boys' physical fighting and life success in adulthood based on data from a variety of sources: a nationally representative, large-scale survey following participants from adolescence into early adulthood, data from official registers, and intelligence test data. The study has limitations, however. Even though the longitudinal nature of the study and adjustment for a variety of relevant confounders provide important information on the temporal association between adolescent boys' physical fighting and adult life outcomes, the associations may also be explained by unobserved confounders. Previous research has suggested several possible confounding factors that are not measured in this paper such as violent victimization, neighborhood factors, and self-control. Being able to include self-control, other factors related to personality, and neighborhood factors in the analyses would have strengthened the study. Further, the time point of the assessment of intelligence succeeded the measurement of physical fighting. This could open the possibility that low intelligence test scores in young adulthood are in part a consequence of an antisocial lifestyle and low academic interest during adolescence, rather than a precursor of physical fighting. However, previous research has shown that intelligence is rather stable during adolescence and young adulthood (Deary, 2014). Therefore, the subsequent assessment of intelligence should not have had a major impact on the results from the analyses. Finally, generalizability might be an issue worth discussing. Norway has a low rate of violent crime, unemployment rates are very low, and the social security network is tight, which all might influence the identified association between adolescent boys' physical fighting and adult life success. However, the analyses still show detrimental long-term effects of physical fighting among Norwegian boys, a finding that we expect to be even more profound in countries with a weaker social security network. Moreover, only boys were included in the study and studies are lacking on whether results can be generalized to girls. Future research should examine whether associations between physical fighting

and life outcomes may be even more pronounced among girls, because physical violence is less frequent (Kann et al., 2018) and considered less normative among girls than among boys (Gilbert, 2002).

5 | CONCLUSIONS

This study is the first to consider long-term outcomes of one of the most frequent acts of violence among adolescent boys—physical fighting. The study also provides new knowledge about mechanisms of the interplay between adolescent boys' physical fighting and intelligence in explaining adult outcomes. In general, boys' physical fighting is related to adverse adult outcomes in employment, education, and crime. Further, individual variation in intelligence is relevant for understanding the association between adolescent boys' physical fighting and adverse adult outcomes. Boys with higher intelligence participate less often in physical fighting than boys with lower intelligence, inducing a spurious relationship between adolescent fighting and some adult life outcomes. However, direct associations between fighting and most of the measured outcomes also persist in the final analytic models, and intelligence explains only a small part of the associations between fighting and life outcomes. The analyses also revealed an interaction effect concerning educational outcomes. Boys with high intelligence attained equally high levels of education, independent of whether or not they report fighting during their adolescent years. In contrast, fighting was related to fewer years of education for boys with average and low intelligence. Even though intelligence often is considered a non-modifiable risk factor in relation to future life outcomes, the identified interplay between adolescent boys' physical fighting and intelligence shows that both fighting and cognitive abilities should be considered when designing interventions aimed at reducing negative long-term outcomes of adolescent conduct problems.

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