

Population-Based Studies of Bullying in Young Children

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Chapter 1

Introduction

INTRODUCTION

School bullying is defined as repeated and intentional aggression toward the peers who have difficulty to stop or counteract such harassment.^{1,2} Bullying and victimization have serious negative effects on health and functioning of children.³⁻⁵ Detecting and preventing bullying problems early in the schooling process is an opportunity to protect children from long-lasting adverse health consequences.^{6,7} A comprehensive understanding of school bullying, its prevalence and the associated with it risk factors form the basis of evidence-based prevention programs. Whereas the importance of early preventive efforts has been widely recognized^{8,9}, studies of bullying among young elementary school children remain scarce, as most of research is usually carried out among adolescents. With the help of large, prospective, population-based studies of children from preschool age onwards, we can gain a better understanding of the risk factors associated with bullying. This thesis describes several population-based studies that address bullying involvement in early elementary school, with a specific focus on its assessment, prevalence and early-age predictors.

Prevalence of bullying and different types of bullying behavior

The majority of studies that report prevalence of bullying involvement were carried out among children in late elementary or secondary schools.^{6,10-16} Fewer studies examined it in early elementary school children or in kindergarten children.^{5,17} Whereas the estimates of bullying involvement vary between countries (sometimes as much as 9%-54%^{14,18}), on average it's prevalence is between 20-30%¹⁴⁻¹⁶: generally about 10% are classified as bullies, 11% as victims and about 6% as bully-victims.^{14,15} Considering that population-based studies examining prevalence of bullying involvement in children who are just starting elementary school are scarce, it remains unclear how prevalent the problem of bullying is at young age. Thus, in this thesis (chapter 2), we examine the prevalence of bullying and victimization in the first grades of elementary school, using a large population-based sample of schoolchildren.

Taking a closer look at bullying involvement shows that there are age¹⁹ and sex²⁰ differences in prevalence and types of bullying behavior. Generally, bullying and victimization rates are higher at younger age^{16,21} and they tend to decrease at older age.^{18,22} Whereas the likelihood of becoming a victim of bullying is similar in boys and girls, the overall rates of bullying are higher among boys.^{18,21,23} This is an expected pattern as it is well-established that boys generally demonstrate higher levels of anti-social behavior than girls.²⁴ Importantly, there are some sex differences in the types of bullying behavior; boys show more overt aggression, i.e. aggression, which is displayed openly toward a victim during face-to-face interactions^{25,26}, whereas covert (or indirect) aggression, which mainly manifests in subtle behaviors, is common in both boys and girls²⁶. To illustrate, boys are more often the perpetrators of physical or verbal bullying²³, whereas girls engage more often in gossiping, friendship manipulation

and social exclusion.^{23,25} However, the magnitude of the sex differences in the latter form of aggression is only trivial.²⁶ Taken altogether, the most common forms of bullying are physical, verbal and relational.²³ These different forms of bullying behavior manifest already at a young age.¹⁷ Accordingly, in the studies presented in this thesis, we examine sex differences in bullying and study different types of bullying involvement. More specifically, when assessing children's bullying involvement in early elementary school, we study physical (e.g. hitting, kicking, pushing), verbal (e.g. name calling), material (e.g. taking or damaging other child's belongings) and relational (e.g. socially excluding) bullying. These types of bullying and victimization were previously implicated in bullying involvement of young children.¹⁷

Participant roles in bullying and consequences of bullying

During a typical bullying incident at school only few children demonstrate the actual acts of aggression toward a victim (e.g. physical harassment of a victim); however, most of the peers are usually present during such incidents or are well aware of them. In this way all the children in a class contribute to the process of bullying, even if it is simply by passively observing it.²⁷ For this reason, next to the central roles of a *bully*, *victim* and a *bully-victim* researchers also define the roles of assistant, reinforcer, defender, and outsider.²⁸

A *bully* is typically described as someone who initiates bullying and shows (mostly) proactive aggression toward the peers. Bullies value dominance and social status in a group, and they are often central figures in their peer networks.²⁹ The *victim* is the target of bullying. Importantly, two types of victims are usually distinguished – the *passive and submissive victims* (i.e. nonaggressive children) and the *aggressive victims* (i.e. provocatively or reactively aggressive children).^{1,29-31} The latter group of children are sometimes referred to as provocative victims, reactive victims or bully-victims.^{27,32} Regardless of how this group is 'labeled', researchers agree that these children's behavior is characterized by two key aspects: (1) these children are involved in bullying both as bullies and as victims, and (2) these children are highly aggressive and problematic.³² The distinction between different roles is important in understanding of bullying processes as these children tend to have different behavioral profiles, and may differ in the way bullying involvement affects them. Children who are a (pure) *victim* of bullying often have internalizing problems (e.g. withdrawn, shy and anxious), and are characterized as unassertive, submissive and insecure, and sometimes physically weaker.²⁹ In contrast, a bully-victim's behavior is typically described as provocative, hot-tempered, highly aggressive and disruptive.^{1,30,33} In sum, the conceptual arguments are in favor of differentiating between the victims only and the bully-victims. These different roles can be defined already at young age,^{17,34} and thus in this thesis we also distinguish the different roles in bullying involvement (i.e. bully, victim, bully-victim, defender).

Bullying involvement has short- and long-term negative consequences for all children who are affected by bullying problems. However, consequences are most severe for those who are engaged in it directly. Children involved in bullying as a bully, victim or a bully-victim are more likely to have a psychiatric condition.³⁵⁻³⁸ Bullies are more likely to engage in risk-taking behavior, e.g. delinquency, addiction, violence and crime involvement.^{39,40} Victims of bullying are at risk of depression, poor self-worth, post-traumatic stress and suicidality.⁴¹ The bully-victims are the group of children who tend to show the greatest levels of psychopathology.⁶ In the studies presented in this thesis, the focus is primarily on children who are involved in bullying directly – that is either as a *bully*, *victim* or a *bully-victim*, as these children are known to fare worse than those who are less directly affected by bullying problems.^{3,6,38-40,42}

Bullying is one of the most researched topics in behavioral sciences, despite the fact that the first scientific enquiries into the issue appeared only some 40 years ago. There is an abundance of scientific reports from studies ‘of different shapes and colors’ that tested different theories about a role of various factors and their associations with child bullying involvement. In our view, most of those factors can be grouped in two: child-level factors, e.g. psychosocial or social cognitive characteristics, and environmental factors, e.g. peer group, school or family characteristics. As a brief recap of what is known about bullying and the role of these factors in it, in the next section we briefly describe the common theories and the supporting them empirical evidence.

Theoretical background

The problem of bullying is very complex, which makes it challenging to study it and to manage it. First, it is considered to be a *group process*.²⁷ This is because it is systematic and continuous, and because almost all members of a group are involved in bullying, either actively – as a perpetrator or victim, or passively – as a by-stander or observer.²⁷ Second, it has an elusive nature: even though bullying manifests in concrete and systematic acts of aggression by identifiable individual(s) toward a specific peer, its consequences can be dangerously intangible, resulting into negative group dynamics. This happens because bullying is tied into group norms and social reputation: it sets the stage for establishing the peer status of a bully (relative to the rest of the group), and it contributes to forming a negative social reputation of a victim.⁴³

Several theories can be helpful in understanding bullying behavior. Whereas there are various theories (some emphasize the role of a group, other the role of the environment or characteristics of a bully-victim dyad), we focus on those theories that are most relevant in the context of this thesis. In a nutshell, these theories can be described as follows.

The *social-ecological theory* is one of the most general perspectives on bullying behavior. It proposes that bullying behavior of a child is shaped by reciprocal influences of individual char-

acteristics of a child (e.g. impulsiveness, anger or gender), peer and school factors (e.g. social support) and family and neighborhood characteristics (e.g. negative family environment or unsafe neighborhood).⁴⁴ Whereas, most studies tend to focus on individual characteristics of a child or parenting styles^{45,46}, fewer examined the role of such environmental factors as family and school socioeconomic characteristics. Also, there is some evidence indicating that family and neighborhood socioeconomic characteristics may influence children's bullying behavior.^{16,47,48} In order to better understand the role of these factors, in chapter 2 of this thesis, we use a large population-based sample to examine the association of family and neighborhood socioeconomic characteristics with child bullying involvement in early elementary school.

The *group functioning* theory emphasizes the role of group processes and group dynamics in bullying victimization. It suggests that bullying is motivated by the goals of a group, such as cohesion and homogeneity, which are essential for an effective functioning of a group.⁴⁹ Following this view, bullying victimization results from a mismatch between the group goals and the particular characteristics of a specific individual.⁴⁹ The group ensures its functioning by 'outcasting' the individuals who 'clash' with the group norms or who may threaten the achievement of the group goals. And in contrast, those children, who actively facilitate the achievement of group goals, are more likely to obtain status, power and privileges in the group.⁴⁹ These processes probably also shape the group norms to some extent. Bukowski and Sippola⁴⁹ argue that two groups that are most likely to be victimized are children who are either highly aggressive (i.e. extremely disruptive to the rest of a group), or those who are passively withdrawn, as their behavior is least constructive for the functioning of a group. Indeed, studies show that children with disruptive behavior, such as attention deficit hyperactivity problems or conduct problems, report high levels of bullying and victimization.⁵⁰⁻⁵² Their aggressiveness and behavioral problems may make them likely to engage in bullying behavior. In turn, their behavioral problems may be perceived as disruptive by the peer group and can predispose them to victimization.²⁹ Thus, such preschool behavioral problems as ADHD and ODD may indicate children's vulnerability to bullying problems at school. However, examining such preschool vulnerability in young children calls upon prospective studies with extensive assessments of behavior. One of the studies presented in this thesis (chapter 5) describes a prospective relation between early-manifesting behavioral problems (i.e. child attention deficit/hyperactive problems and oppositional defiant problems) and bullying involvement in early elementary school. This study examines the antecedent effects of behavioral problems in relation to school bullying.

From the perspective of the *social dominance theory*, aggression and bullying are the means by which children can establish social dominance in a group, especially in the newly formed groups such as a new school class.⁵³ In cases of proactive aggression, bullying is considered to be driven by a goal of obtaining advantageous status in a peer group, which seems to work

effectively as adolescents tend to perceive bullies as popular and powerful.⁴³ Unsurprisingly, bullies also strongly value dominance and high social status.⁴³ Thus, at least to a certain extent bullying is driven by a motivation to obtain a higher social status in a peer group. A *goal-framing approach*⁵⁴ is related to these group processes, and it suggests that individuals are likely to perceive a situation positively or negatively based on the belief of how favorable that situation (or any specific actions in that situation) is for the achievement of their goals. Thus, when a child strongly values social status and peer affection, this child is likely to look for opportunities to dominate in the group (possibly by bullying). At the same time the child is likely to try to maintain peer affection among those, whose opinion is important to this child. Following this view, bullies tend to select their victims strategically. A strategically chosen victim is a child that is unlikely to retaliate, someone who is rejected by peers, or whose bullying is likely to be “approved” by the peers.²⁹ These peer interactions are heavily influenced by child sex, especially at young age.^{55,56} Therefore, young children’s behavior (e.g. bullying or defending) is likely to be influenced by attitudes of the same-sex peers. Even though the relation between bullying and peer affection has been examined in older schoolchildren⁵⁷, less is known about bullying, victimization, defending, peer acceptance and rejection at the start of elementary school. How are these peer relations influenced by the sex of a child? Examining these peer processes on a dyadic level can enhance the understanding of the group dynamics at young age. Thus, in chapter 4 of this thesis, we examine sex differences in bullying, victimization, defending, and peer acceptance and rejection, using a dyadic approach to peer relations.

The *social information processing* model⁵⁸ implies that social-cognitive deficits are core to peer aggression. This model suggests that an aggressive behavioral response results from the way a child perceives, evaluates and interprets social cues.⁵⁸ Biases in social information processing may trigger an aggressive response. For instance, bullies have positive cognitions with regard to the use of aggression as they perceive it to be an effective tool to achieve their goals.²⁹ Whereas the role of social cognitions and social information processing in peer aggression is well established^{59,60}, little is known about the role of other aspects of child cognitive functioning, namely executive function and IQ. This issue certainly deserves exploration as it is known that aggression is more prevalent in children with weaker cognitive skills, and intelligence negatively correlates with aggression.^{61,62} Also, some studies reported that aggression is associated with poor executive function.⁶³ The term “executive function” refers to the self-regulation mechanisms of controlling own thoughts, actions and emotions. These skills are essential in situations requiring goal-setting or problem-solving. Executive function typically denotes child inhibitory abilities, control over emotions, ability to plan and organize thoughts and actions. Whereas some studies reported an association between the impairments in child executive function and aggressive behavior, little is known about the role of executive function in school bullying. Therefore, in chapter 6 of this thesis, we examine children’s executive function and non-verbal intelligence in relation to bullying involvement at school.

The *social learning theory* posits the importance of observational social learning. Children learn from the behavior they observe in aggressive models⁶⁴. It is suggested that, in a similar way, exposure to media may be associated with aggressive behavior⁶⁵. Given the high exposure of children to media and the saturation of TV content with aggressive program content⁶⁶, some studies examined the effects of the time children spend viewing TV at preschool age, and indicated that TV exposure is associated with risks of behavioral and social problems.^{67,68} The findings of these studies are consistent with the general recommendation for parents advising them to limit young children's TV viewing to no more than 2 hours daily.⁶⁹ It is believed that, besides learning from the aggressive content, extensive TV exposure may negatively affect child development because: (a) watching TV is a passive activity; (b) time spent on TV watching comes at the expense of the time that could have been spent on more developmentally appropriate activities (e.g. reading, playing with the peers); and (c) the intensity of visual images and sounds may be too rapid for young children to be able to process them adequately.⁷⁰ A few studies suggested an association between early-age TV exposure and bullying⁷¹ and victimization.⁷² However, prospective longitudinal studies of young children that could examine whether TV exposure time and program content watched at young age affect children's behavioral problems or bullying involvement are largely lacking. In this thesis, we examine whether television viewing at young age poses a potential risk of developing externalizing problems (chapter 8) or a risk of becoming involved in school bullying (chapter 9).

Another aspect of vulnerability to bullying problems, namely a high body mass index (BMI) at young age, is examined in chapter 7 of this thesis. Following the theoretical view on bullying as means of establishing high social status in a group, bullies are believed to choose their targets strategically, that is: a bully is more likely to victimize a child who is an attainable target rather than a child who is likely to retaliate effectively in response to the victimization.²⁹ From this perspective, being larger and (physically) stronger may be an advantageous characteristic of a bully targeting a weaker student. At the same time, heavy children may also be a target of bullying because of their weight. According to Lerner's theoretical model, an individual's physical appearance influences the reactions and behavior of others, especially in the environments with the set beauty standards.⁷³ Recent evidence indicates that children who are overweight or obese tend to experience a range of social problems. For instance, being overweight/obese has been associated with lower self-esteem, having fewer friends and with social withdrawal.^{74,75} Furthermore, overweight and obese (pre)adolescents were reported to be more frequently victimized⁷⁶⁻⁷⁹ and to bully others more often than their normal-weight peers^{77,78}. Considering the reported risks of bullying involvement among (pre)adolescents with overweight/obesity⁷⁶⁻⁷⁸ and the high prevalence of overweight problems at young age^{80,81}, in chapter 7 we examine whether children with overweight or obesity are at an increased risk of bullying involvement in the first grades of elementary school.

Behavioral problems and bullying: a prospective view

The relation between child problem behavior and bullying involvement is a classic chicken and egg question. There are studies showing that involvement in bullying as a bully, victim or a bully-victim is associated with concurrent and subsequent psychopathology.^{6,10,35,42} The most common (concurrent) diagnoses among children, who are involved in bullying, are ADHD and ODD.³⁶ At the same time, it is suggested that early problem behavior may increase children's vulnerability to bullying involvement.⁸² For instance, anxious children may be more attainable targets of bullying, as they are more vulnerable than other peers, and thus, are less likely to retaliate. Similarly, children with disruptive behavior, such as those who demonstrate attention/hyperactivity or oppositional behavioral problems already at preschool age, may be more likely to develop problems with peers once they begin school.⁸² Furthermore, involvement in bullying or experiencing victimization may exacerbate these pre-existing problems or trigger the development of new problems in these children. Studies that could examine the relation between early-age behavioral problems and subsequent bullying involvement prospectively are largely lacking. To bridge this gap, we examine the relation of attention/hyperactivity and oppositional behavioral problems at preschool age with bullying involvement in the first grades of elementary school (chapter 5). Such a study has the capacity to establish whether early-age behavioral problems precede school bullying.

Assessment of bullying

Assessment of bullying involvement is one of the central issues in this thesis. Inevitably, most of the assessment methods and instruments have some advantages and some limitations, leaving researchers with a difficult choice of a suitable method of studying their research question in children of a specific age. Ideally, information from multiple sources should be gathered as the multi-informant approach combines different perspectives and thus, is most likely to provide a "complete" picture of what is being studied.²⁹ This approach tackles the problem of shared method variance that often occurs in studies in which exposure and outcome are both reported by the same informant. Certainly, feasibility and cost-effectiveness analysis of the use of a method play an important role in choosing the assessment method of a study.

In the field of bullying research, the following informants are typically used to assess bullying and victimization: children themselves, their peers, teachers and parents. Clinicians or school nurses are rarely used as informants. The agreement between different reporters is usually poor.³¹ This partly reflects the differences in methodologies and partly the differences in informants' perspectives with regard to the studied issue. It is believed that each informant uniquely contributes to the understanding of the problem, and that e.g. child self-report and peer reports provide complementary to one another information.⁸³ Even though a multi-informant approach is favored, in most studies researchers assess bullying using only a child,

parent or a teacher report of bullying involvement. The choice of the method and informant also depends on the age of children. At young age, reports of parents and teachers are often collected using questionnaires.⁴³ Commonly, a parent or a teacher is presented with several questions about a child's possible involvement in bullying in a span of the past few months. The adult is then asked to report the frequency of bullying events. In one of the studies described in this thesis, we too obtained teachers' reports of bullying involvement using such a questionnaire. Teachers of a large population-based sample of children from the first grades of elementary school in Rotterdam reported about different types of bullying behavior in their class. This approach provides an excellent opportunity to examine the prevalence of bullying and victimization at young age.

At young age, child self-report is used less frequently because extensive questionnaires are rather lengthy and thus can be difficult for young children to fill-out independently. On the contrary, in studies of adolescents, self-report and peer reports are frequently used as this is a convenient and a cost-effective method of bullying assessment. When collecting self-reports, children are asked to fill-out a questionnaire to report whether and how often they bully others or are bullied by others (usually in a specified period of time e.g. in the current term or in the past three months). Next to self-ratings, peer nominations are commonly used with adolescents.⁸³ When this method is used, children are provided with similar to the described above questions and with the names of their classmates that serve as answer options; children are then asked to choose/nominate those peers who are often involved in bullying in their class. This sociometric method is considered to be highly valid because the obtained information is based on reports of multiple peers, and thus it contains little error variance.^{29,84} Precision of such sociometric information is likely to be magnified if a *dyadic* peer nomination approach is used. Dyadic nominations⁵⁷ are the kind of nominations where children report specifically about their *own experience*. For instance, they are asked to nominate *their* aggressors, as opposed to reporting who bullies in their class in general. Thus, the dyadic type of peer nominations has the advantage of obtaining the victim's perspective of victimization as well as the objective perspective of the peers on bullying behavior of each child. Also, having established that bullying is a group process, which needs to be studied as a group phenomenon,⁸⁵ making use of peer nominations brings us closer to measuring bullying as a group phenomenon. In this thesis, we study bullying involvement from the perspective of the entire group, using dyadic peer nominations. In chapter 3, we examine whether peer relations, including bullying involvement, can be assessed using a computerized, animated peer nomination measure in a large sample of elementary school children.

Aim

This thesis is an endeavor of gaining a better understanding of the problem of bullying in early elementary school, focusing on its assessment and on the associated with bullying risk

factors. Our main goals were: (1) assess bullying involvement at young age using different measurement methods and different informants; (2) examine the role of the socioeconomic and demographic factors in bullying involvement; and (3) study whether early-age behavioral, cognitive, physical and environmental factors are associated with a risk of bullying involvement at school. The studies addressing these goals are presented in this thesis as following. In chapter 2, the prevalence of teacher-reported bullying involvement in the first grades of elementary school is examined. Also in this chapter, the family and neighborhood socioeconomic influences on bullying involvement are studied. Chapter 3 describes the sociometric assessment of peer relations at young age using the dyadic peer nomination method. Chapter 4 focuses on sex differences in peer relations in early elementary school. In chapter 5, the relation between preschool behavioral problems and school bullying is described. Chapter 6 examines the role of child cognitive functioning in bullying and victimization. Chapter 7 describes the relation between child body mass index and bullying involvement. The final chapters of the thesis focus on the effects of TV exposure at early age on child behavioral problems (chapter 8) and on bullying involvement at school (chapter 9). The concluding part of the thesis (chapter 10) is devoted to the general discussion of the study findings, important methodological considerations and practical implications.

Setting

The prevalence of bullying and victimization was studied using teacher-reported data obtained from the population-based survey – the Rotterdam Youth Health Monitor of the Municipal Public Health Service. This general surveillance method forms an important part of the continuous governmental monitoring of health and well-being of children and youth in Rotterdam and surrounding area. In the study presented in chapter 2, the data from 2008-2009 survey of children (age 5-6 years) was used. Elementary school teachers filled-out questionnaires about children's bullying involvement (n=6376). Parents of these children provided information on socioeconomic status of their families.

All other studies that are described in this thesis, were embedded in the Generation R Study,⁸⁶ a large population-based birth cohort in Rotterdam, the Netherlands. This prospective cohort study from fetal life onwards is set up to detect environmental and genetic factors influencing growth, development and health from fetal life until young adulthood.⁸⁶ In this cohort study, 9778 pregnant women living in Rotterdam (delivery dates between April 2002 and January 2006) were enrolled through midwives and obstetricians. Those women who could not be enrolled during pregnancy were approached after their child's birth, during their routine visits to a child-health center. The response at the start of the study was 61%; the rates throughout the follow-up until the age of 6 years exceeded 80%. All participants provided written informed consent. The Generation R Study was approved by the Medical Ethics Committee of the Erasmus Medical Centre. During the prenatal phase, at preschool age and at age 6 years,

regular extensive assessments (e.g. questionnaires and observations) have been carried out in children and their parents.^{86,87} Bullying involvement information reported by the teachers was available for 5383 children participating in the Generation R Study at school age.

The peer nomination method was used to measure peer relations and bullying in a large sample of children studying in the first grades of elementary school in Rotterdam and suburbs (n=4017). This study of peer relations was carried out in collaboration with the Generation R Study.⁸⁶ During this peer assessment, the age and gender were the only background data that were obtained from schools. Collaboration with the Generation R Study enabled us to combine the peers' reports at school with the background variables of participants in the Generation R Study, which were collected before the peer assessment. At the time the peer assessment was carried out, the oldest Generation R children were in elementary school grades 1–2. Of the 4017 children who completed the peer measure, 1590 were participants of the Generation R Study. The rest of the children were the classmates of the Generation R participants, who provided the peer reports of bullying. This sample of Generation R children was used to examine the early-age risk factors of child-reported bullying involvement.

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Chapter 2

Prevalence of bullying and victimization among children in early elementary school: Do family and school neighbourhood socioeconomic status matter?

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ABSTRACT

Background: Bullying and victimization are widespread phenomena in childhood and can have a serious impact on well-being. Children from families with a low socioeconomic background have an increased risk of this behaviour, but it is unknown whether socioeconomic status (SES) of school neighbourhoods is also related to bullying behaviour. Furthermore, as previous bullying research mainly focused on older children and adolescents, it remains unclear to what extent bullying and victimization affects the lives of younger children. The aim of this study is to examine the prevalence and socioeconomic disparities in bullying behaviour among young elementary school children.

Methods: The study was part of a population-based survey in the Netherlands. Teacher reports of bullying behaviour and indicators of SES of families and schools were available for 6379 children aged 5-6 years.

Results: One-third of the children were involved in bullying, most of them as bullies (17%) or bully-victims (13%), and less as pure victims (4%). All indicators of low family SES and poor school neighbourhood SES were associated with an increased risk of being a bully or bully-victim. Parental educational level was the only indicator of SES related with victimization. The influence of school neighbourhood SES on bullying attenuated to statistical non-significance once adjusted for family SES.

Conclusions: Bullying and victimization are already common problems in early elementary school. Children from socioeconomically disadvantaged families, rather than children visiting schools in disadvantaged neighbourhoods, have a particularly high risk of involvement in bullying. These findings suggest the need of timely bullying preventions and interventions that should have a special focus on children of families with a low socioeconomic background. Future studies are necessary to evaluate the effectiveness of such programs.

BACKGROUND

Bullying and victimization are widespread phenomena in childhood and can take several forms, such as name calling, gossiping, exclusion, and hitting or pushing [1]. Children's involvement in bullying, either as a bully or victim, has a serious impact on their well-being [2-8]. Victims are at increased risk of future poor physical health, low self-esteem, and psychiatric problems, such as anxiety disorders, depression, and psychotic symptoms. Bullies have more behavioural problems and a poorer emotional adjustment later in life. Moreover, victims and bullies tend to perform less well at school than children who are not involved in bullying [3, 6]. Children can also be involved in bullying behaviour both as bully and as victim, and these so-called bully-victims have a particularly high risk of later psychosocial problems [9, 10]. These adverse consequences are independent of pre-existing behavioural and emotional problems at the time the bullying and victimization takes place [2-8].

Several prevalence studies indicated that bullying and victimization are a common problem in elementary and secondary school classes [3-8, 11-14]. Large cross-national research, for instance, showed that on average 27% of children in secondary schools were involved in bullying: approximately 13% of the children reported being a victim of bullying, 11% a bully, and 4% a bully-victim [14]. In general, boys are more often involved in bullying than girls [12-15]. In contrast to the abundance of large-scale studies in children in secondary school and higher grades of elementary school, there is little evidence that bullying and victimization already exists among younger children [16-20]. A few small-scale studies in kindergarten and the first grades of elementary school focused only on victims and reported varying prevalence rates of victimization ranging from 2% to 27% [16, 17, 19]. Hence, it remains rather unclear to what extent bullying and victimization affects the lives of young children [16-20].

It is important that children with an increased risk of becoming a bully or victim are identified at a young age so as to facilitate timely prevention of bullying and victimization. Identification is enhanced by knowledge on determinants and predictors of bullying behaviour. Previously, studies on determinants of bullying mainly focused on individual traits of children and on the influence of parenting styles [6, 21, 22]. For instance, bullies often have an impulsive and dominant temperament and are frequently exposed to harsh child-rearing practices at home. Recently, considerable attention has been paid to socioeconomic predictors of school bullying. This has led to the postulation that involvement in bullying behaviour might explain part of the socioeconomic disparities in mental health problems [23]. For instance, it has been shown that adolescents from families with a lower socioeconomic status (SES) are more often victimized and face more severe long-term mental health consequences of this victimization as compared to victims from more affluent social backgrounds [23]. Other studies have confirmed that victimization rates were higher among children with a low socioeconomic background as indicated by their parents' low-skill occupations or low educational attainment, lack of material resources, and single parenthood [19, 24-28]. Like victimization,

bullying seems to be socially patterned by parental socioeconomic status as well [13, 28, 29]. Besides family SES, school neighbourhood SES might also predict bullying behaviour because characteristics of school neighbourhoods, e.g. crime rates, social support and control, and common norms and values, are likely to influence children's behaviour [30, 31].

The aim of this study is to assess the prevalence of bullying and victimization among young elementary school children and to examine socioeconomic disparities in bullying behaviour. We hypothesize that school neighbourhood SES is associated with bullying behaviour independent of family SES. To improve understanding of bullying, three types of involvement in bullying are studied: victims, bullies, and bully-victims. The present study is embedded in a large population-based sample of 5- and 6-year old children in the second grade of elementary school. Teacher reports of bullying are used as teachers can observe peer interactions during daily school curriculum and, arguably, provide more objective information on bullying behaviour than parents [32].

METHODS

Design

Data from the population-based Rotterdam Youth Health Monitor of the Municipal Public Health Service were used. This health surveillance system is part of government approved routine health examinations and monitors the health and well-being of children and youth living in Rotterdam and surrounding areas. The information is used for individual referral and guides youth policies of schools, neighbourhoods, and the municipality. The Medical Ethical Committee EUR/AZR of the Erasmus University/Academic Hospitals approved the use of data obtained by the Municipal Public Health Service for routine monitoring purposes for scientific publications (MEC 168.344/1998/43). The present study is based on data obtained from parental and teacher questionnaires. Parents were informed about the teacher questionnaire and were free to withdraw consent. Active consent is not required by Dutch law.

Study population

For the present study, we used 2008/2009 survey data of children aged 5-6 years ($n=11,419$). The elementary school teachers of these children were asked to complete a questionnaire for each child in their class. This resulted in teacher reports of bullying behaviour for 8871 children (response rate 77.7%). Parental questionnaires containing information about indicators of SES were available for 6376 of these children.

Measures

Bullying and victimization

Bullying and victimization during the past three months were studied as outcome. The teacher of each elementary school child rated the occurrence of four victimization and four bullying items [20]. The victimization items assessed 1) “whether a child was physically victimized by other children, for instance by being hit, kicked, pinched, or bitten” (further referred to as physical victimization); 2) “whether a child was verbally victimized, such as being teased, laughed at, or called names” (verbal victimization); 3) “whether a child was excluded by other children” (relational victimization); and 4) “whether belongings of a child were hidden or broken” (material victimization). Bullying was assessed with the perpetration form of these four items, e.g. “Whether a child physically bullied other children”. Examples of physical and verbal victimization / bullying were added to the items, and we provided concrete descriptions of relational and material victimization / bullying. A pilot study had indicated that teachers thought these examples and descriptions were more helpful for consistent answering of the items than a formal definition of bullying. Each item was rated on a four-point rating scale ranging from “Never or less than once per month” to “More than twice per week”. Children with a “Never or less than once per month”-rating on all four bullying and four victimization items were classified as uninvolved children. Children were classified as victims if they experienced any of the four victimization types at least once a month. Likewise, children were classified as bullies if they perpetrated any of the forms of bullying at least once a month. Children meeting the criteria of both bullies *and* victims were categorized as bully-victims.

Family socioeconomic status

Information on indicators of family socioeconomic status was assessed by a parental questionnaire and, thus, obtained independently from the teacher questionnaire. The educational level of both parents was considered as an indicator of family SES because education structures income and occupation (economic status), but also reflects non-economic social characteristics, such as general knowledge, problem-solving skills, literacy, and prestige [33, 34]. The highest attained educational level of mothers and fathers was divided into: “Primary education”, which typically corresponds to ≤ 8 years of education; “Lower vocational training”, corresponding to 9-12 years of education; “Intermediate vocational training”, equivalent to 13-15 years of education; “Higher vocational training”, which corresponds to 16-17 years of education; and “Higher academic education”, equivalent to 18 years of education or more [35]. Given that the highest obtained schooling significantly structures occupational levels [33], we included (un)employment status – instead of occupational level – as an indicator of family SES. Unemployment is generally seen as a strong indicator of low socioeconomic status [34]. Employment status was categorized as “At least one of the parents employed” and “Both parents unemployed”. The latter category indicated that none of the parents had paid em-

ployment and were comprised of parents who were in the categories of housewife/husband, student, job-seeker, or social security or disability benefit recipient. Proxy indicators of low SES used in this study were a young parental age and single parenthood, which was defined as “parents not living together”.

School neighbourhood socioeconomic status

The *SES of school neighbourhoods* was determined by linking the school postal code areas with neighbourhood level status scores obtained from the Netherlands Social and Cultural Planning Office [36]. These status scores are based on educational levels, income, and unemployment rates in neighbourhoods between 2002 and 2006. The status scores reflect standard deviation scores from a nation-wide mean of zero and range between -5.5 and 3.3. The mean status score in the study area was -0.41 (100% range: -3.8 to 3.3). Lower scores indicate more social disadvantage. The SES scores of school neighbourhoods were divided into quartiles.

Confounders and multilevel measures

Child gender, age and national origin were considered as possible confounding factors in the association between SES and bullying behaviour. The national origin of the child was based on country of birth of both parents, as assessed by the parental questionnaire. A child was classified as non-Dutch if one or both parents were born abroad [37].

Statistical analyses

The distribution of separate bullying and victimization items was analyzed, stratified by child gender. Differences in prevalence of bullying and victimization items were also presented by educational level of the mother, as maternal education is considered to be one of the strongest socioeconomic markers of child health and behaviour [38]. Differences by gender and by maternal educational level were tested with the χ^2 -statistic. Based on the separate bullying and victimization items, children were categorized as uninvolved children, victims, bullies, or bully-victims. The relation between SES indicators and involvement in bullying and victimization was examined with multinomial logistic regression analyses. We calculated the odds ratios (ORs) for each of the three categories of involvement in bullying (victim, bully, bully-victim) as compared to uninvolved children (reference group). The association of SES indicators with involvement in bullying and victimization was examined first for each indicator separately. These analyses were adjusted for confounding variables child age, gender, and national origin. Next, to estimate whether family SES and school neighbourhood SES independently contributed to the risk of bullying behaviour, we performed regression analyses including indicators of family SES and school neighbourhood SES in one model. As maternal and paternal education (Spearman's $\rho=0.63$) and age of mothers and fathers (Pearson's $r=0.59$) were highly correlated, only maternal education and age were included in the full model. The model was then repeated, including paternal education and age instead of maternal education and age. The

effect estimates of the full model include the maternal variables. To obtain a p-value for trend, the analyses were repeated, this time including educational level and school neighbourhood SES as continuous variables. Data was analyzed in a two-level structure with children clustered within classes because teachers rated bullying and victimization for all children in their class. All variables were analyzed at the individual level, except for school neighbourhood SES, which was included as a class-level variable. In the multivariate analyses, missing values on the SES variables and confounders were dealt with by the full information maximum likelihood (FIML) method in Mplus Version 5 [39]. FIML estimates model parameters and standard errors using all available data while adjusting for the uncertainty associated with missing data [40]. Analyses were performed using SPSS Version 17.0 [41] and Mplus.

Non-response analysis

The distribution of involvement in bullying and victimization was compared between children with ($n=6379$) and without ($n=2492$) the parental questionnaire available. Children with missing data were more often involved in bullying than children without missing data (42.0% vs. 33.9%, $p<0.001$). This was reflected in higher percentages of victims (5.4% vs. 4.0%), bullies (18.2% vs. 16.9%), and bully-victims (18.4% vs. 13.1%).

RESULTS

The study population was composed of 51% boys. More than half of the children had a Dutch background (57%). Most parents had an intermediate vocational training (mothers: 36%; fathers: 32%), which typically corresponds to 13 to 15 years of education. In 13% of the families, neither of the parents had paid employment.

The frequency of various bullying and victimization items is presented in Table 1. Physical bullying (16%), verbal bullying (22%), and relational bullying (27%) were highly common behaviors in early elementary school. Likewise, physical victimization (8%), verbal victimization (11%), and relational victimization (9%) were also common, although to a slightly lesser degree. Physical, verbal, and material victimization and bullying occurred more often in boys than in girls, while relational victimization and bullying was more prevalent among girls. A rather small percentage of bullying and victimization occurred on a weekly basis, e.g. physical victimization 1%. Supplementary Table 1 shows a clear socioeconomic gradient (as indicated by the level of education of the mother) for the types of bullying and victimization: physical, verbal, relational and material bullying, and victimization were all more prevalent among children of mothers with a low educational level as compared to children of higher educated mothers.

Based on the eight bullying and victimization items presented in Table 1, children were classified in four groups: uninvolved children, victims, bullies, and bully-victims. Figure 1 shows

Table 1. Prevalence of victimization and bullying for all children and by gender

Items		Percentage based on past 3 months		
		Never [#]	Monthly	Weekly [§]
Victimization				
Physical	All	91.7	7.1	1.2
	Boys	88.0	9.9 ^a	2.1 ^b
	Girls	95.6	4.2	0.2
Verbal	All	89.4	9.2	1.4
	Boys	87.5	10.8 ^a	1.7 ^b
	Girls	91.5	7.4	1.1
Relational	All	91.1	7.6	1.3
	Boys	91.6	6.8 ^a	1.6 ^b
	Girls	90.7	8.4	0.9
Material	All	99.3	0.7	0.1
	Boys	99.0	0.9 ^a	0.1
	Girls	99.5	0.5	0
Bullying				
Physical	All	84.1	11.3	4.6
	Boys	76.6	16.1 ^a	7.3 ^b
	Girls	92.0	6.3	1.7
Verbal	All	77.9	16.8	5.3
	Boys	73.2	19.4 ^a	7.4 ^b
	Girls	82.9	14.0	3.1
Relational	All	83.4	13.8	2.8
	Boys	85.6	11.4 ^a	2.9
	Girls	81.1	16.3	2.6
Material	All	97.1	2.4	0.5
	Boys	96.0	3.2 ^a	0.9 ^b
	Girls	98.3	1.5	0.2

Notes Table 1:

[#] Never or less than once per month.[§] The categories of "One to two times per week" and "More than twice per week" were collapsed into the category "Weekly" due to very low prevalences.^a Prevalence of never vs. monthly or ^b vs. weekly involvement in bullying differs significantly between boys and girls, $p < 0.05$.

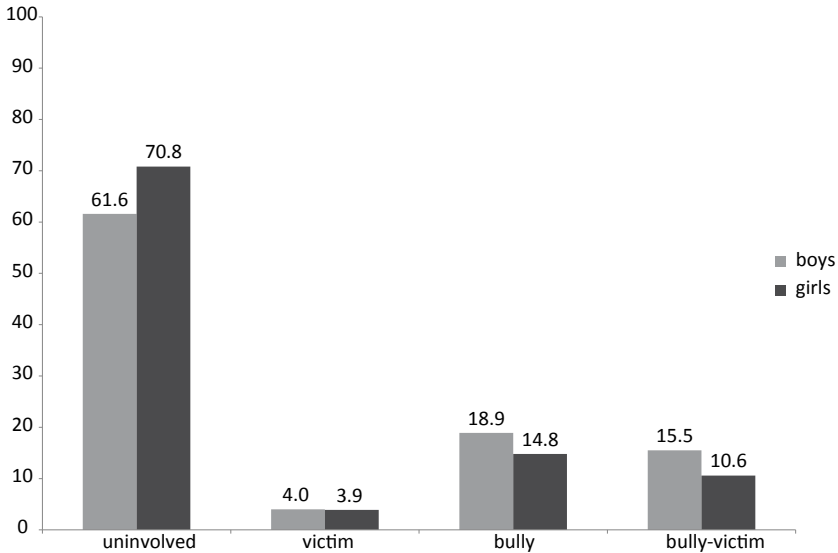


Figure 1. Prevalence of involvement in bullying and victimization by gender (n=6376)

the distribution of these groups stratified by gender. The majority of children in early elementary school (66.1%, n=4214) were not involved in bullying and victimization. Among those children involved, 4.0% was a victim of bullying (n=252), 16.9% a bully (n=1075), and 13.1% a bully-victim (n=835). Boys were more often bullies ($p<0.001$) or bully-victims ($p<0.001$) than girls were.

Table 2 shows the association between SES and risk of involvement in bullying and victimization. Indicators of family SES were highly associated with bully and bully-victim status: single parenthood, young parental age, low educational level of parents, and parental unemployment increased the risk of children being a bully or bully-victim (see Table 2). Of all indicators of family SES, only low educational level of parents was associated with victimization (p-values for trend=0.01 and 0.02 for maternal and paternal education, respectively). The relationship of school neighbourhood SES with bullying and victimization is also presented in Table 2. Low school neighbourhood SES increased the risk of being a bully or bully-victim although the latter was only marginally significant (low SES: OR=1.45, 95% CI: 1.00-2.10).

Finally, the independent effect of family SES and school neighbourhood SES on risk of involvement in bullying behaviour was estimated. Table 3 shows that, adjusted for family SES, the association between school neighbourhood SES and involvement in bullying was not significant anymore. The ORs for the family SES variables were attenuated slightly, but all except parental employment status remained significant predictors of bully or bully-victim status. Again, victimization was only predicted by parental education. Results were approximately the same if paternal age and education were included in this model instead of maternal age and education.

Table 2. Effects of socioeconomic determinants on involvement in bullying

Indicators of socioeconomic status	N [§]	Odds ratios for involvement in bullying and victimization (95%-CI) [#]				
		Basic model without mutual adjustment for indicators of SES				
		Uninvolved (n=4214)	Victim (n=252)	Bully (n=1075)	Bully-victim (n=835)	
Age mother (per 5 year decrease)	6161	Reference	1.12 (0.99-1.26)	1.10 (1.03-1.18)	1.18 (1.08-1.28)	
Age father (per 5 year decrease)	5825	Reference	1.07 (0.96-1.19)	1.07 (1.01-1.13)	1.15 (1.07-1.24)	
Single parenthood	6155	Reference	1.23 (0.89-1.70)	1.69 (1.41-2.02)	1.58 (1.27-1.95)	
Educational level mother:						
Higher academic	655	Reference	Reference	Reference	Reference	
Higher vocational	1020		1.20 (0.60-2.38)	1.12 (0.81-1.54)	1.33 (0.86-2.04)	
Intermediate vocational	1952		1.22 (0.65-2.32)	1.38 (1.03-1.85)	1.60 (1.07-2.40)	
Lower vocational	1318		1.48 (0.76-2.88)	1.51 (1.11-2.06)	1.98 (1.29-3.02)	
Primary education	414		2.05 (0.97-5.25)	1.56 (1.06-2.31)	2.18 (1.31-3.63)	
			<i>p-value for trend</i>	0.01	0.001	<0.001
Educational level father:						
Higher academic	837	Reference	Reference	Reference	Reference	
Higher vocational	963		1.11 (0.60-2.06)	1.08 (0.79-1.47)	1.15 (0.78-1.69)	
Intermediate vocational	1613		1.45 (0.83-2.53)	1.12 (0.84-1.49)	1.13 (0.79-1.62)	
Lower vocational	1250		1.85 (1.05-3.25)	1.41 (1.05-1.90)	1.51 (1.03-2.19)	
Primary education	352		1.82 (0.87-3.79)	1.90 (1.30-2.79)	1.99 (1.23-3.20)	
			<i>p-value for trend</i>	0.02	<0.001	<0.001
Employment:						
At least one parent employed	4852	Reference	Reference	Reference	Reference	
Both parents unemployed	745		1.17 (0.78-1.74)	1.61 (1.29-2.00)	1.57 (1.21-2.04)	
School neighbourhood SES:						
High	1861	Reference	Reference	Reference	Reference	
Mid-high	1678		0.77 (0.56-1.07)	1.24 (0.96-1.59)	1.10 (0.77-1.57)	
Mid-low	1524		0.98 (0.67-1.44)	1.29 (1.00-1.67)	1.14 (0.79-1.64)	
Low	1313		0.86 (0.59-1.24)	1.49 (1.14-1.93)	1.45 (1.00-2.10)	
			<i>p-value for trend</i>	0.10	0.003	0.32

Footnotes Table 2:

[#] Analyses adjusted for child gender, age, and national origin.[§] N varies due to missing data in the SES indicators, total n=6376

Table 3. Effects of socioeconomic determinants on involvement in bullying with mutual adjustment for other socioeconomic determinants

Indicators of socioeconomic status	Fully adjusted odds ratios for involvement in bullying and victimization (95%-CI) [#]				
	Model with mutual adjustment for indicators of SES				
	N	Uninvolved (n=4214)	Victim (n=252)	Bully (n=1075)	Bully-victim (n=835)
Age mother (per 5 year decrease)	6161	Reference	1.09 (0.96-1.24)	1.06 (1.00-1.15)	1.15 (1.06-1.25)
Age father (per 5 year decrease)	6161	Reference	1.05 (0.94-1.17)	1.06 (1.00-1.12)	1.15 (1.07-1.23)
Single parenthood	6155	Reference	1.17 (0.80-1.72)	1.52 (1.14-1.80)	1.35 (1.05-1.74)
Educational level mother:					
Higher academic	655	Reference	Reference	Reference	Reference
Higher vocational	1020		1.36 (0.71-2.60)	1.06 (0.77-1.60)	1.32 (0.86-2.02)
Intermediate vocational	1952		1.40 (0.76-2.56)	1.20 (0.90-1.75)	1.56 (1.05-2.33)
Lower vocational	1318		1.70 (0.91-3.18)	1.30 (0.96-1.94)	1.99 (1.31-3.01)
Primary education	414		2.23 (1.08-4.64)	1.35 (0.92-2.24)	2.21 (1.33-3.66)
<i>p-value for trend</i>			0.02	0.01	0.001
Educational level father:					
Higher academic	655	Reference	Reference	Reference	Reference
Higher vocational	1020		1.06 (0.58-1.94)	1.07 (0.80-1.43)	1.14 (0.77-1.69)
Intermediate vocational	1952		1.37 (0.80-2.35)	1.06 (0.81-1.39)	1.14 (0.79-1.65)
Lower vocational	1318		1.81 (1.04-3.13)	1.29 (0.98-1.70)	1.54 (1.05-2.25)
Primary education	414		1.80 (0.87-3.74)	1.68 (1.16-2.45)	2.00 (1.22-3.25)
<i>p-value for trend</i>			0.01	0.002	0.008
Employment:					
At least one parent employed	4852	Reference	Reference	Reference	Reference
Both parents unemployed	745		1.00 (0.62-1.60)	1.15 (0.89-1.49)	1.22 (0.90-1.66)
School neighbourhood SES:					
High	1861	Reference	Reference	Reference	Reference
Mid-high	1678		0.81 (0.58-1.14)	1.00 (0.79-1.28)	0.93 (0.66-1.30)
Mid-low	1524		1.14 (0.85-1.51)	1.10 (0.87-1.40)	0.95 (0.67-1.33)
Low	1313		0.84 (0.61-1.15)	1.13 (0.90-1.43)	1.07 (0.74-1.54)
<i>p-value for trend</i>			0.17	0.55	0.18

Footnotes Table 3:

[#]Analyses include child gender, age, national origin, and all SES-indicators, except age and education of fathers. ORs of paternal variables are derived by repeating the analysis including paternal and excluding maternal age and education.

DISCUSSION

This study showed significant socioeconomic disparities in bullying and victimization in early elementary school: children of lower socioeconomic families had a higher risk of being involved in bullying - either as victim, bully, or bully-victim - than children with a higher socioeconomic background. Before these socioeconomic disparities can be discussed, it is important to consider the reported prevalence rates first. Our findings suggest that bullying and victimization are relatively common problems in the lowest grades of elementary school with about one third of the children being involved. More specifically, we showed that 4% of the children were victims, whereas many children were involved as bullies (17%) or bully-victims (13%). These prevalence estimates, particularly of bullies and bully-victims, are somewhat higher than previously reported prevalence rates among older children and adolescents in the Netherlands and in other countries [14]. However, bullying behaviour tends to decline with age [14, 42]. Possibly, young children solve peer problems with bully behaviour while children's experiences, increasing assertiveness, and changes in capabilities and social skills might result in more adequate problem solving skills at older ages [43]. Our finding that bully-victims are highly represented while pure victimship is much less common contrasts with previous research among older children indicating that bully-victims are relatively rare compared with pure victims. It might be that children shift between categories such that young bully-victims become pure victims over time; however, this hypothesis and the possible explanations for such a shift can only be examined in a study with a longitudinal design. Yet, the high prevalence of children classified as bully-victims at this young age might also reflect general conflicts between children rather than bullying behaviour that is associated with an imbalance of power.

Previous studies among children in kindergarten in Switzerland and the U.K. observed fairly similar patterns of teacher reported bullying and victimization as we did (e.g. bully-victims: 11% and 13%) [18, 20]. However, research among young children in the U.S.A. indicated parent reported victimization rates of 23-27% [16, 17]. These percentages are substantially higher than we observed, even when keeping in mind that victimized children in our study were found in two categories, i.e. the victims and the bully-victims. Differences in prevalence could be due to dissimilarities in the definition of victimization, but they might also be explained by the use of other informants, since teachers rate in a different context and with different references than parents [17, 18]. On the other hand, a recent study indicated that the prevalence of victimization as reported by teachers or parents was fairly similar [44]. Another explanation comes from cross-national studies in older children and adolescents indicating that bullying and victimization rates are slightly higher in the USA than in the Netherlands [16, 17, 26, 29].

Socioeconomic disparities in bullying and victimization

The present study showed a strong socioeconomic gradient for different types of bullying and victimization with particularly marked differences in physical, verbal and relational bullying and victimization. Likewise, a strong association between family SES and involvement in bullying was shown: single parenthood, a young age and low educational level of parents were independently associated with the risk of children being bullies or bully-victims, which is in line with few previous studies in older children [13, 28, 29]. In contrast, being a victim was predicted by only a few indicators of family SES: only low maternal and paternal education was associated with a significant, nearly two-fold increased risk of victimization. Previous studies also found an educational gradient in victim status [19, 24], but associations with other family SES indicators like single parenthood and parental occupation have been reported as well [19, 23, 25, 26]. Results are, however, difficult to compare because the victimized children in our study were found in the victim and bully-victim categories.

The influence of several family socioeconomic characteristics was independent of school neighbourhood SES. Conversely, although greater neighbourhood socioeconomic disadvantage was associated with an increased risk of being a bully or bully-victim, this effect was not independent of family SES. This is in contrast with our empirically based hypothesis that school neighbourhood SES might affect bullying behaviour through various characteristics of school neighbourhoods [30, 31]. A possible explanation is that prior intervention efforts and extra attention of teachers in socially disadvantaged neighbourhoods has resulted in a decrease in bullying prevalence in these areas, whereby the association between school neighbourhood SES and bullying has disappeared. It might also be that school neighbourhoods become more important when children are somewhat older. Our findings are, however, consistent with epidemiological research on other outcomes than bullying and victimization, suggesting that the effects of individual level SES might be stronger than neighbourhood SES effects [45].

Low socioeconomic background of families might have influenced children's involvement in bullying and victimization in several ways. Parental educational level reflects intellectual resources, general and specific knowledge, norms and values, literacy, and problem solving skills [33, 46], all aspects that could be related to child raising behaviour and, consequently, to children's development of social skills and coping strategies. Additionally, it has been shown that children of low-educated parents watch more television than children of high-educated parents [47, 48]. Possibly, exposure to violent television programs might stimulate bullying and peer aggression [49]. The association between single parenthood and the risk of children being a bully or bully-victim could be explained by less time for parent-child interaction. This could result in reduced parental control of children's behaviour and limited time for parents to talk about the problems a child encounters in daily life, such as difficulties in peer relations. Alternatively, the effect of single parenthood could be accounted for by the stress inherent to a situation of broken families. Stress and parental well-being are known to

have adverse influences on children's behaviors in multiple ways [50]. Regarding employment status, we showed that children of whom both parents are unemployed were more likely to be a bully or bully-victim. This effect was explained by other SES indicators suggesting that parental unemployment is associated with children's bullying behaviour through its relation with low educational level, single parenthood, and disadvantaged school neighbourhoods.

Strengths and limitations

The present study was strengthened by its population-based design, large sample size, and the use of several socioeconomic indicators to conceptualize the multiple dimensions of SES [46, 51]. Moreover, the multilevel models accounted for intra-class correlation arising from the fact that teachers reported bullying behaviour for all children in their classroom, and that children within the same class are more alike than children from different classes [31]. Limitations of this study include the use of a single informant of bullying and victimization. In principle, a teacher's bias against children of lower socioeconomic backgrounds can affect ratings [52]. Multiple informants could also generate more accurate data on less overt bullying behaviours such as relational bullying [53]. Moreover, although we aimed to reduce teacher's subjective opinions by providing examples and concrete descriptions of the different bullying and victimization types, the degree of agreement between teachers' ratings is not known, as we did not assess inter-rater reliability. Furthermore, although bullying is a persistent process, a one-time measurement may coincide with some uncertainty due to changes in children's behaviour and class composition over time. Another limitation of our study was that the non-response analyses indicated that the lack of information on SES was not completely random. Finally, we lacked possibilities to examine mechanisms explaining the association between SES and bullying behaviour at schools. Future studies should investigate the role of family and school influences, such as norms and values, and prevalence of vandalism.

Implications

Our population-based study assessed prevalence of bullying and victimization among children in the first grades of elementary schools. This provides scholars and public health practitioners information on the prevalence of an important social behaviour that is a risk factor for later behavioural and emotional problems [2-8]. Considering the incessant nature of bullying and reports showing that by middle school both bully and victim roles are rather stable [54], the high prevalence of bullying and victimization shown in this study suggests the need of prevention and intervention programs at the start of elementary school. Our findings provide insight into which forms of bullying are common at this age, which is essential for tailored-made interventions targeting the most prevailing forms of bullying behaviour. Physical and verbal bullying was widespread; these overt behaviours can easily be recognized and are a possible target of intervention by school teachers. However, relational bullying was also a common behaviour that can be missed more easily. Therefore, it is important that teachers

in early elementary school are made aware that relational bullying is a common behaviour in their class room, especially among girls. We also showed that children of families with a low socioeconomic background have a particularly high risk of involvement in bullying. The socioeconomic inequalities were not restricted to a specific type of bullying behaviour but were found in all forms of bullying and victimization. These findings should be taken into account in the development of bullying prevention or intervention programs as targeted programs may be more effective when actions are directed at the most prevailing forms of bullying and at the susceptible group of children. It might be worthwhile to teach children with a low socioeconomic background certain social skills and strategies to cope with peer problems and bullying situations. Possibly, children from families with a low SES do not learn such skills from their parents. The effectiveness of such intervention strategies and of general bullying interventions among young children in early elementary school should be monitored in future research.

CONCLUSIONS

From previous research, it is known that bullying and victimization are widespread phenomena in secondary school and higher grades of elementary school. The present study adds to this literature by demonstrating that bullying behaviour is already a common problem in early elementary school. Children from socioeconomically disadvantaged families have an increased risk of being involved in bullying, especially as a bully or bully-victim. Our findings suggest the need of timely bullying preventions and interventions that should already be implemented at the start of elementary school. These programs should have a special focus on at-risk children of families with a low socioeconomic background. Future studies are necessary to evaluate the effectiveness of such programs.

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SUPPLEMENTARY MATERIAL

Supplementary Table 1. Prevalence of victimization and bullying by educational level of the mother

Items	Educational level	Percentage based on past 3 months			χ^2 -test for overall difference
		Never [#]	Monthly	Weekly [§]	
Victimization					
Physical	Higher academic	95.9	3.5	0.6	<0.001
	Higher vocational	93.3	6.1	0.6	
	Intermediate vocational	92.5	6.5	1.1	
	Lower vocational	89.7	8.8	1.5	
	Primary education	89.6	8.7	1.7	
Verbal	Higher academic	94.0	5.0	0.9	0.001
	Higher vocational	92.1	7.1	0.8	
	Intermediate vocational	89.7	8.9	1.3	
	Lower vocational	88.1	10.4	1.4	
	Primary education	87.7	10.4	1.9	
Relational	Higher academic	94.3	4.9	0.8	<0.001
	Higher vocational	92.8	6.7	0.5	
	Intermediate vocational	92.2	6.5	1.3	
	Lower vocational	90.2	8.5	1.3	
	Primary education	85.5	13.0	1.4	
Material	Higher academic	99.7	0.2	0.2	<0.001
	Higher vocational	99.4	0.6	0	
	Intermediate vocational	99.5	0.5	0	
	Lower vocational	99.2	0.8	0	
	Primary education	97.8	1.5	0.7	
Bullying					
Physical	Higher academic	91.0	5.5	3.5	<0.001
	Higher vocational	88.2	9.3	2.5	
	Intermediate vocational	84.9	11.1	4.0	
	Lower vocational	81.3	12.8	5.8	
	Primary education	79.2	13.3	7.5	

Supplementary Table 1. Prevalence of victimization and bullying by educational level of the mother (*continued*)

Items	Educational level	Percentage based on past 3 months			χ^2 -test for overall difference
		Never [#]	Monthly	Weekly [§]	
Verbal	Higher academic	86.6	9.8	3.7	<0.001
	Higher vocational	82.6	14.3	3.0	
	Intermediate vocational	78.9	15.8	5.3	
	Lower vocational	75.6	18.7	5.8	
	Primary education	69.5	22.8	7.7	
Relational	Higher academic	89.4	9.3	1.2	<0.001
	Higher vocational	87.4	11.9	0.8	
	Intermediate vocational	84.0	13.3	2.7	
	Lower vocational	82.6	14.2	3.2	
	Primary education	77.2	16.9	5.8	
Material	Higher academic	99.1	0.5	0.5	<0.001
	Higher vocational	97.9	2.1	0	
	Intermediate vocational	97.0	2.5	0.5	
	Lower vocational	97.2	2.3	0.5	
	Primary education	94.0	4.8	1.2	

Notes Table 1:

[#] Never or less than once per month.[§] The categories of "One to two times per week" and "More than twice per week" were collapsed into the category "Weekly" due to very low prevalences.

Chapter 3

Detecting bullying in early elementary school with a computerized peer-nomination instrument

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ABSTRACT

In this study we describe the PEERS Measure, a computerized assessment instrument that takes an innovative approach to using the peer-nomination method to identify bullying among elementary school children in grades 1-2. Its psychometric characteristics were measured in 4017 children from 190 school classes. The inter-correlations between the peer-nomination scores showed congruence of the data (e.g., bullying and peer rejection $r=.51$, defending and prosocial behavior $r=.71$). Boys were more involved in bullying, were more rejected, and less prosocial. As reports by different informants were used, correlations of peer-reported bullying with aggressive behavior reported by a child him/herself ($r=.37$) or by a teacher ($r=.42$) were in the expected range. Good test-retest reliability as measured by the ICCs (average: $.72$) further suggests that the instrument has good psychometric properties. In line with earlier research, lower maternal educational levels, younger maternal age and lower household income were related to more bullying and victimization. Overall, our findings show that the instrument provides a reliable measure of peer relations, thus making the use of peer nominations feasible in early elementary school.

BACKGROUND

Bullying is already common at the start of elementary school, and makes a unique contribution to the development of psychosocial problems in young children (Arseneault et al., 2006; Kochenderfer & Ladd, 1996; Perren & Alsaker, 2006). A child's involvement in bullying is associated with an increased risk of problematic health outcomes, such as psychosocial adjustment problems, depression, borderline personality symptoms, and psychotic symptoms (Arseneault et al., 2011; Wolke, Schreier, Zanarini, & Winsper, 2012). Involvement in it at early elementary school is worrisome, not only because early victimization is likely to be stable over time (Barker et al., 2008; Boulton & Underwood, 1992), but also because children who are continuously victimized tend to have the poorest health outcomes (Barker, Arseneault, Brendgen, Fontaine, & Maughan, 2008). Although the early detection and prevention of bullying problems is crucial, relatively few studies have examined the problem of peer victimization in early elementary school, partly due to the difficulties of measuring bullying in young children.

As Salmivalli & Peets (2009) state, classroom context plays an important role in the occurrence of school bullying. Irrespective of whether only two children or more are involved in bullying, all the children in a school class represent the social context within which the status of bully and victim can be understood relative to other group members (Salmivalli & Peets, 2009). The classroom is therefore an important social context for bullies to establish their status with respect to their peers. Naturalistic observations of peer interactions showed that 88% of bullying episodes occurred in the presence of the classroom peers (Hawkins, Pepler, & Craig, 2001).

Because distress and anxiety can result from being a witness to bullying (Janson & Hazler, 2004), it is clear that bullying processes have negative effects not only on the victims but also on other children in the peer group. The behaviors of peers during bullying episodes influence bullying processes: whereas a smaller number of children try to stop it by defending the victim, most peers actively or passively reinforce it (Salmivalli, Lagerspetz, Björkqvist, Österman, & Kaukiainen, 1996). Taking a specific role in bullying situation depends on many factors, including a child's own current status in the group, his/her relationship with the bully and the victim, fear of becoming a target of bullying, empathy, and, importantly, normative classroom beliefs about bullying (Salmivalli & Peets, 2009). Bullying thus depends greatly on the classroom context.

Bullying is a group process involving all the children in a group, whether actively or passively (Salmivalli, et al., 1996). One technique for studying the perceptions and experiences of all the children in a group – and thus class – is the *peer-nomination method*. Once the ratings of *all the peers* in a class are aggregated, it becomes easier to obtain a reliable and objective measure of bullying at group level. Information on the bullying involvement of each dyad in a class can be generated through the use of *dyadic nominations*, which can be used to elicit

who bullies whom; bullying-involvement scores can then be aggregated on the basis of the ratings of all the children in a school class (Veenstra et al., 2007).

Importantly, young children were shown to be consistent in nominating the aggressors (Monks, Smith, & Swettenham, 2003) – demonstrating that the peer-nomination method is indeed suitable for assessing victimization in children in the first grades of the elementary school. Because, in the peer-nomination method, a child's involvement in bullying is determined on the basis of the ratings from all the children in a school class, this approach provides complete and reliable information. Some earlier studies used the peer-nomination method in interviews to assess peer aggression: children were asked questions by a researcher and were asked to answer by mean of nominating their classmates (Ladd & Kochenderfer-Ladd, 2002; Monks, et al., 2003; Österman et al., 1994; Perren & Alsaker, 2006; Vermande, van den Oord, Goudena, & Rispens, 2000).

One of these studies, a study of kindergarten children by Perren and Alsaker (2006) showed that age-appropriate use of the peer-nomination method (e.g., with the help of printed illustrations during an interview) makes it possible to capture different forms of bullying, and to measure negative and positive forms of peer relationship. The authors assessed bullying and victimization by interviewing 344 children aged 5-7 years. During the interviews, the term "bullying" was explained with the help of four cartoons that depicted children bullying other children (Perren & Alsaker, 2006). Children were asked about four different forms of bullying: physical bullying, verbal bullying, object-related/material bullying, and exclusion. To help them with their peer nominations, children were shown the photographs of their peers in their kindergarten class, and were asked to nominate the bullies and their victims.

Several other research groups have successfully used the peer-nomination method in interviews with young children (Ladd & Kochenderfer-Ladd, 2002; Monks, et al., 2003; Österman, et al., 1994; Vermande, et al., 2000). Ladd and Kochenderfer-Ladd (2002) collected peer reports of victimization in 197 six-year-olds and their classmates by using photos of the children and by asking the interviewees to nominate the victims of physical and verbal peer aggression. Monks and colleagues (2003) conducted interviews with 104 children aged 4-6 using pictures with stick figures to depict the aggressor and victim in situations of physical and verbal aggression, social exclusion, and rumor-spreading. Children were first asked whether anyone in the class behaved like this towards others. Then, in order to identify those who did so, they were asked to nominate classmates, including themselves.

Similarly, Österman (1994) used peer-ratings and self-ratings of victimization and of physical, verbal and indirect aggression to interview 404 eight-year-olds. They found that peer reports of aggression were more consistent than self-reports (Österman, et al., 1994). But as the opposite was found for victimization, it seemed better for children to report on victimization themselves and for peers to report on bullying. When asking children to nominate their peers in this study, the authors used a group photo of all the children in the class.

Vermande et al. (2000) also used the peer-nomination method to assess aggression in 1090 five-year-olds, asking them to nominate their aggressors. Like Österman (1994), Vermande and colleagues (2000) asked children to nominate their aggressors, and not about own roles as bullies, in order to avoid social-desirability bias.

While this interview-based peer-nomination method has been used successfully, it remains a challenge to use the peer-nomination method with young children. Interviewing each child is elaborate and time-consuming; health practitioners, researchers, and school staff may also lack the necessary resources or skills. Although, with older children, lists with the names of participating children can be used to aid the process of peer nominations, it can be quite burdensome for first-graders to answer a number of questions while going through long lists of classmates' names. In early elementary school, children find it easier to understand questions with the help of illustrations; earlier research has also showed the use of cartoon methodology in interviews about peer relations to be successful (Perren & Alsaker, 2006; Smith, Cowie, Olafsson, & Liefvooghe, 2002). Similarly, it may be more suitable when studying bullying in young children to use children's photos rather than lists of names during the peer-nomination procedure.

On the basis of the above, we developed the PEERS^a Measure, an instrument that would allow young children to answer questions about peer victimization and nominate peers independently rather than in an interview. Intended to enable them to report on their own experience of being victimized, and to be rated by their peers for bullying, the PEERS Measure is a computerized assessment that takes an innovative approach to using the dyadic peer-nomination procedure with children aged 6-10. It is an interactive assessment instrument that enables children to complete the task independently by following audio instructions and by using illustrations and photos to answer the questions. As a standardized assessment instrument, it is suitable for collecting dyadic/network data on different forms of bullying, and on peer acceptance, peer rejection, and prosocial behavior.

For purposes of validation of the PEERS Measure, we also examined the role of the background variables such as *gender*, *age*, *child ethnicity* and *family socioeconomic background* in bullying involvement. With regard to gender, victimization rates among boys and girls are fairly similar (Jimerson, Swearer, & Espelage, 2010): while the risk factors for bullying involvement in boys and girls are virtually the same, research suggests that the perpetration of bullying is more prevalent among boys, except for indirect forms of bullying, such as relational bullying (e.g., social exclusion), which are more common among girls (Arseneault, Bowes, & Shakoor, 2010; Björkqvist, Lagerspetz, & Kaukiainen, 1992).

With regard to the relationship between bullying and child age, involvement in bullying is already common at the start of schooling (Jansen et al., 2012). The highest prevalence is

^a "PEERS" stands for peer evaluation of relationships at school (in Dutch: pesten en relaties op school).

in the first grades of elementary school (Karna et al., 2011); at the end of middle school, the prevalence gradually decreases.

Ethnicity and family socioeconomic background were both shown to be related with bullying involvement at school. Earlier studies in the Netherlands reported that children from ethnic minority groups were involved in bullying more than their Dutch peers were (Jansen et al., 2013; Verkuyten & Thijs, 2002), as was a family's socioeconomic status (reflected in parental educational level and family income). For example, children of single parents and of parents of a lower educational level were found to be involved in bullying more than those from a higher socioeconomic background (Jansen, et al., 2012).

The overall objectives of this study were to examine the psychometric properties of the PEERS Measure by evaluating its test-retest reliability and its internal consistency, the correlations between its scales, the socio-demographic correlates of bullying and victimization, and its consistency with other measures of child aggressive behavior. We therefore wished to establish the following: (a) the interrelationships between the constructs of the PEERS Measure; (b) whether the instrument has sufficient test-retest reliability and internal consistency, and how PEERS bullying scores relate to other measures of child aggression; and (c) whether child and maternal socio-demographic characteristics are associated with children's bullying involvement, and whether these associations are consistent with earlier research.

METHODS

Design and study participants

Elementary schools in Rotterdam received a letter with a booklet about the study, and were invited to visit the website describing the study and PEERS Measure. Researchers then phoned the schools. If a school agreed to participate, the letters and booklets for parents of the children were sent to the teachers, who were asked to distribute them to the parents, and to inform them about the upcoming study. Eighty-two schools were invited to participate, some of them repeatedly. Over two school years, 37 schools participated (school response rate 45%), five of them more than once.

To examine possible selection bias, the 37 schools which were willing to participate in the study were compared with the 45 schools which did not participate. This was done on the basis of the total number of children that attended them, and the socioeconomic status (SES) of the school neighborhood. For this, we used official national reports on school size and neighborhood social status. Scores reflecting the SES of the neighborhood were based on the income, educational level and employment of the residents in the area.

The mean total number of pupils in the participating schools was 347 ($SD=166$); the mean number in the non-participating schools was 310 ($SD=165$). The number of pupils per school did not differ significantly between the schools that participated and those that did not $t(80)=$

-1.02, *n.s.* With regard to the comparison of SES scores of the schools' neighborhoods, a lower score represents a more affluent SES. As with pupil numbers, SES scores did not differ significantly between the schools that participated ($M\text{ SES}=0.77, SD=1.37$) and those that did not ($M\text{ SES}=1.16, SD=1.44$), $t(80)=1.23, n.s.$

In total, 4087 children (target age 6 – 10 years) from 190 classes at the participating 37 schools were eligible for participation (see supplementary Figure 1). The parents of each child received a letter and booklet about the study, and were invited to visit a website containing more information on the topic, and also a demo-version of the PEERS Measure.

Informed passive consent was obtained from parents and children. This meant that once parents had been informed about the study, they still had an opportunity to withdraw their child's participation: If they did not wish their child to participate, they were asked to inform a teacher or researcher before the assessment. Children were informed at school about the research and gave oral consent before the assessment.

The decision to use passive consent was based on five considerations. First, similar consent procedures had been used in earlier studies that used peer nominations with young children – in Switzerland, the UK and the Netherlands (Monks, et al., 2003; Perren & Alsaker, 2006; Vermande, et al., 2000). Second, passive consent would reduce the risks of selection bias and of the participation rate being too low to obtain representative reports from peers. Third, we relied upon the earlier positive experience of the schools, in which the PEERS Measure had been piloted, and the local public-health authorities with passive consent. We drew on the experience of Rotterdam's City Public Health Services, which use passive consent in the administration of yearly surveillance questionnaires at elementary schools in the city and its suburbs. Fourth, we considered the non-experimental nature of the study and its negligible health-related risks. Fifth, we ensured that option was provided for withdrawing from participation at any time during the study. Not only would parents have the opportunity to withdraw their child's participation, but the children themselves could refuse to participate in the study on the day of testing.

When being instructed on the PEERS Measure, children were informed that their answers would be treated confidentially. After the assessment had been completed, researchers debriefed each child. Feedback was also obtained from teachers. Teachers of the participating classes received reports that contained general and confidential results. The present study was approved by the Medical Ethics Committee at Erasmus University Medical Center in Rotterdam, the Netherlands (MEC-2010-230).

In the pilot study that had been carried out in three schools ($n=209$) we evaluated the PEERS Measure on the basis of a checklist on the following aspects: a) informing parents and consent procedure; b) working with the PEERS assessment system; c) communication and collaboration with the school staff and introducing the study to children; d) obtaining photos of the participating children; e) instructions for children before the assessment; f) size of the groups of children for simultaneous testing; g) the age-appropriateness of the PEERS Mea-

sure (computer skills, ability to focus, understanding of the method); h) time to complete the PEERS Measure; i) understanding the questions and the concept of bullying; In consultation with the experts in the field of child development and peer relations, the instrument was evaluated and adapted on the basis of researchers' experience during the pilot study, and of feedback from schools and children.

As participation was not allowed by parents of 70 of the 4087 schoolchildren who had been invited to participate, the study sample consisted of 4017 children (participation rate 98%). Data were collected in three waves over two school years. For our analyses we used the data from the first assessment in a group of children who participated over two school years. Peer-nomination data were available for all 4017 children. Although self-report data were not obtained for 115 of the 4017 children, as they were absent from school on the day of the PEERS assessment, peer-reported data were available on these children.

The test-retest analyses were performed in a sample of 123 children studying in the same class in the same school year (43.9% boys, mean age 7.67 years, $SD=9.07$ months). The time interval between the two assessments was 3 months.

The study evaluating the PEERS Measure was carried out in collaboration with the Generation R Study (Jaddoe et al., 2010), a large population-based prospective cohort in Rotterdam, the Netherlands. Generation R is designed to identify early environmental and genetic causes and causal pathways leading to normal and abnormal growth, development and health during fetal life, childhood and adulthood. It enrolled 9778 mothers living in Rotterdam whose delivery dates lay between April 2002 and January 2006, and who had been recruited through midwives and obstetricians. Pregnant women who could not be approached during pregnancy were approached in the first months after their child's birth, when newborns visited the routine child-health centers. The response at baseline was 61%, and general follow-up rates until the age of 6 years exceed 80%. All participants provided written informed consent. The Generation R Study was approved by the Medical Ethics Committee at Erasmus University Medical Centre.

During the Generation R Study, regular extensive assessments have been conducted during the prenatal phase, at preschool age and at later ages (Tiemeier et al., 2012). As well as questionnaires, detailed physical and ultrasound examinations, data collection in mothers, fathers and children includes behavioral observations and biological samples. In 2012, the 6-year examination wave was completed. In it, 6694 children were assessed, each with a parent; 594 children participated by questionnaire only. In total, parents gave consent for 8306 children, and children participated at least with health-care data.

As the present study of peer relations used passive consent, age and gender were the only background data we were allowed to obtain on the children participating in the PEERS assessment. Embedding the current study into the Generation R Study enabled us to combine peers' reports at school with the background variables of participants in the Generation R Study, which were collected before the PEERS Measure.

When the present study was carried out, the oldest Generation R children were in elementary school grades 1-2. This means that 1590 of the 4017 children in our sample were also participants in the Generation R Study. Before the study started, written permission to merge Generation R Study data at schools and registries was obtained from the parents participating in the Generation R Study (MEC 2007-413). The schools invited for assessment with the PEERS Measure were selected randomly from the list of schools that had at least one Generation R Study participant in grades 1-2 during the academic year in which the PEERS data were collected.

General analyses were conducted regarding 4017 children who completed the PEERS Measure. Some additional analyses were conducted in a subgroup of children who participated in the Generation R Study, i.e., for whom background information and additional assessments of behavior were available ($n=1590$ children). The extra assessments of child behavior available for these children included the Berkeley Puppet Interview ($n=1330$) and Teacher Report Form ($n=1160$) of aggressive behavior at school (Ablow, 2003; Achenbach & Rescorla, 2001).

Procedure and content

The PEERS Measure, which is an interactive animated web-based computer program, was used to assess peer relationships in elementary school children in grades 1-2. Before the assessment, researchers visited schools to discuss logistical issues with the directors and teachers, and to tell children about the study. Information on children's names, dates of birth and gender were obtained from the school registries. Recent portrait photographs of the participating children (required for peer nomination questions) were either provided by the school or were taken by a researcher during an introduction visit. Before the PEERS Measure was administered, the demographic data and photographs were entered into the PEERS assessment program. The procedure children followed when completing the PEERS Measure was standardized and a strict protocol was followed at all times.

Each PEERS assessment was carried out in a group of six to eight pupils. The teachers of the participating classes needed to make no substantial time investment, as all testing was done by the researchers. Before administration of the measure started, a researcher gave children instructions about the PEERS Measure, and explained the meaning of bullying through the illustrations contained in the measure. After the general introduction, children were seated at computers, each at a sufficient distance to ensure privacy. Once the task started, children heard a short introduction and instructions via a headset. The assessment began with a self-identification task to check whether a child could recognize him/herself and his/her classmates in the photos. Then, to familiarize children with the nomination technique, two exercise questions followed during which children were asked to nominate an animal they liked most and an animal they liked least.

Throughout the PEERS Measure children had to answer questions about peer rejection and acceptance, victimization, defending and prosocial behavior. The questions about victimiza-

tion were based on earlier studies of young children (Jansen, et al., 2012; Perren & Alsaker, 2006). Perren and Alsaker (2006) used cartoons of four forms of bullying to interview 5 to 7-year-olds on bullying and victimization. Using photos of classmates, they then asked the children to point at those involved in bullying. In our study, too, children were presented with pictures depicting the four forms of bullying, and were asked to nominate classmates who demonstrated such behaviors. However, to improve the reliability of the information we would obtain, the children in our study were asked to report who bullied *them*. The mean age we targeted was slightly higher than in Perren and Alsaker's study (2006), as we wished to create an instrument which children could complete independently. Similar to this study, we used photos depicting four forms of bullying to illustrate bullying incidents.

The concept of bullying was operationalized according to the traditional definition (Olweus, 1993), which emphasizes purposive, repeated and continuous nature of aggression, and also an inability, or weakened ability of a victim, to defend oneself. For the exact wording of the definition of bullying given to children during the instructions, and for the examples of the questions from the PEERS Measure, see supplementary material.

During the PEERS Measure, but before the peer-nomination questions, children were asked six *yes-no questions* on victimization, defense, and prosocial behavior. Affirmative answers to them were later used as a measure of frequency of that specific behavior.

Next, children were asked to *nominate* their classmates. This part of the PEERS Measure started with questions about *peer acceptance and rejection*. The children were told to imagine that they were going on an exciting school trip and could nominate not only children they would like to take with them (peer acceptance), but also those they would rather not take (peer rejection). To answer these questions, they should click on the photos of the classmates, which were displayed in random order.

Next, children were asked questions on four different forms of *peer victimization*: (1) physical bullying, i.e., physical peer aggression such as hitting, kicking or pushing; (2) verbal bullying, i.e., behaviors such as calling names or saying mean or unkind things; (3) material bullying such as taking away or breaking other child's belongings; and (4) relational bullying, a concept that referred mainly to social exclusion. The task ended with a question on *defending* and a question on *prosocial behavior*. All questions in the PEERS Measure were accompanied by an audio and visual description of a situation specific to the concept in question.

Children were asked to nominate those classmates whose behavior towards them demonstrated the behavior in question. For instance, after a verbal form of bullying had been explained, the children were asked "*Does anyone in your class do such things to you?*" If the answer was affirmative, they were then told "*Click on the pictures of the classmates who often say mean things to you.*" Such a procedure was used after each behavior in question had been explained through visual and audio instructions (see supplementary materials for transcript of the audio and illustrations of the PEERS Measure).

Children could nominate classmates by clicking on their photographs. The number of nominations was restricted to six for peer-acceptance and peer-rejection questions, and to ten for questions on the four forms of victimization, defending and prosocial behavior. Aggregate scores for each form of bullying were calculated using ratings by multiple peers. The number of classmates nominated by each child was used to calculate the self-reported victimization scores. The number of nominations as a bully received by each child was used to compute the peer-reported bullying scores. A similar procedure was used to obtain aggregate scores for peer acceptance, peer rejection, defending and prosocial behavior.

We chose to computerize the task, firstly for reasons of efficiency and standardization, and also to avoid situational effects related to an interviewer's possible influence on a child. Asking open questions was not feasible, as children were intended to complete the task independently. Because it was also important for the nominations to be registered automatically and to be restricted solely to the participating children, the children were presented with the pictures of their participating in the study classmates, and were asked to click on the relevant photos to nominate children who behaved towards them in the way described. If a child wished to nominate a classmate who was not participating in the study, he or she could click on a special "dummy" picture with no photograph.

A trained research assistant supervised children completing the PEERS assignment and was available for questions and help at all times. The average time taken to complete the assignment was 7.6 minutes ($SD=1.9$ minutes). Anonymous ID numbers for all the participating children were generated by the PEERS Measure program. A dataset containing coded data was created automatically after the PEERS Measure was conducted in each class.

Covariates

Age and gender information was obtained for all participants (mean age 7.9 years, $SD=11.2$ months; age range 5.5 – 10.9 years; 49.7% boys). The data of 1590 children participating in the Generation R Study (Jaddoe, et al., 2010) were merged with the PEERS Measure data generated in the current study. For these 1590 children, five socio-demographic characteristics were available: (1) the child's national origin, which was defined by the country of birth of the parents, and was categorized as "Dutch", "Other Western" and "non-Western" (Statistics Netherlands, 2004a); (2) maternal age; (3) maternal education, i.e., the highest *educational level* attained by the mother in 4 categories ranging from "low" (<3 years of general secondary education) to "high" (higher academic education/PhD) (Statistics Netherlands, 2004b); (4) monthly household income, which comprised three following categories, "<€1200" (below social security level), "€1200-2000" (average income), and ">€2000" (modal income); and (5) maternal marital status, which was categorized as "single" and "married/living together".

Consistency with other measures

Peer-reported bullying scores obtained with the PEERS Measure were related to teacher-reports and child-reports of aggressive behavior. A Dutch version of the Teacher Report Form (TRF 6-18 years) (Achenbach & Rescorla, 2001) was used at the mean age 6.5 years ($SD=14.5$ months) to obtain teacher reports of child aggressive behavior problems in the preceding 6 months ($n=1163$, 73% of the present sample; overall TRF response in the Generation R cohort 60%). We used the *Aggressive behavior* scale (20 items) in our analyses as it closely relates to bullying behavior. Examples of the TRF items assessing aggressive behavior are “*Cruelty, bullying or meanness to others*” and “*Destroys property belonging to others*”. Teachers rated the scale items on a 3-point Likert scale ranging from ‘*Not True*’ to ‘*Very True or Often True*’. The TRF has good validity and reliability (Achenbach & Rescorla, 2001). Weighted sum scores were used in the analyses.

Child reports of overt hostility/aggression were obtained using the Berkeley Puppet Interview (BPI), a semi-structured face-to-face interview in which hand puppets are used to obtain standardized self-reported information from young children (Ablow, 2003). The BPI interviews were available for 1356 children, and were conducted at the mean age of 6.1 ($SD=5.0$ months). Overt Hostility/Aggression to Peers scale consisted of 7 items. Examples of the scale items are “*Likes to tease*” and “*Hits other kids*”. The items were coded on a 7-point scale. Summed scale scores were used for analysis, with higher scores representing more problems. The Berkeley Puppet Interview has good psychometric properties (Ablow, 2003).

The mean interval between the peer and teacher assessments was 14.7 months ($SD=15.0$ months), and the mean time difference between the PEERS Measure assessment and the BPI interview was 18.5 months ($SD=8.8$ months). To illustrate the effect of time difference between the assessments, the correlation coefficients between the peer-reported data and the child and teacher reports of aggression were examined in two subgroups: (1) children in whom the two assessments were conducted ≥ 10 months apart, and (2) children whose time between the assessments was < 10 months.

Statistical analyses

The *test-retest reliability* of the PEERS Measure was examined by calculating the intra-class correlation coefficients (ICC). For 123 children who were tested twice during the same school year (with the three months in-between the assessments), we examined the Bland-Altman plot for agreement between the assessments (Bland & Altman, 1986, 1987). In a Bland-Altman plot, the individual differences between the scores from two assessments are plotted against the averages of the two assessments. The mean of the differences and the lower and upper limits of agreement were calculated. As well as examining whether children gave the same (i.e., affirmative or negative) answers to the ‘yes-no’ questions on victimization, defending and prosocial behavior, we also calculated the Pearson’s correlation coefficients for the test-retest

scores. In order to assess the internal reliability of bullying and victimization scales, Cronbach's alpha coefficients were calculated.

Next, we examined the *frequencies of the victimization*. Each form of victimization was introduced by a yes-no question, which was used to determine the occurrence of the respective form of peer victimization. Chi-square test statistics were used to study children's answers to the yes-no questions and gender differences in the frequency of reported victimization.

Subsequently, we analyzed the *peer-nomination scores*. If a child reported being victimized, he or she was asked to nominate the bullies. These nominations constitute the victimization score. At the same time, these nominations also contribute to the aggregate bullying scores of other children in the class. Just as all children could nominate the bullies, each child could also be nominated by other children as a bully; this constituted the bullying score he or she received. For each peer nomination question (verbal, physical, material, relational bullying, defending, prosocial behavior, peer acceptance, and peer rejection) we calculated individual proportion scores per child. These individual proportions reflect the number of nominations given by and received from all the other classmates, weighted by the number of classmates performing the evaluation. In order to derive a total score of a construct (e.g., overall bullying score), these proportion scores were averaged. Bullying scores thus reflect the extent to which a child is perceived as a bully by his or her classmates. Higher values represent more bullying, i.e., the higher the score, the more often a child is named as a bully by the peers. Pearson's correlation coefficients were calculated to examine the associations between the peer-nomination scores. Gender differences in nomination scores were examined using the t-test.

For *validation* purposes we related the PEERS Measure to measures of aggressive behavior assessed with different instruments. We analyzed the correlation coefficients between the bullying scores obtained with the PEERS Measure and (1) child-reported aggression obtained through the Berkeley Puppet Interview and (2) teacher-reported aggression measured by TRF.

Lastly, we used data for 1590 Generation R participants to examine the *child and maternal socio-demographic correlates of bullying and victimization*. Socio-demographic differences were studied using t-test and regression analyses. Additional analyses were carried out to further examine the association between the socio-demographic variables and bullying involvement, also adjusting one for the other and also for child birth-order and maternal national origin.

Analyses were performed using STATA (Stata/SE 12.0, StataCorp LP Texas). As our data was clustered, information obtained from children from the same school classes was likely to be correlated. To account for the clustered structure of the data, we adjusted the standard errors and p-values in our analyses. The reported p-values were derived from analyses using robust standard errors (Huber-White sandwich method).

RESULTS

Consistency and reliability

We analyzed data from 190 school classes ($N=4017$), which had average number of pupils of 21 (minimum 10, maximum 31). The average time to complete the PEERS Measure was 7.6 minutes ($SD=1.9$ min).

We examined the internal consistency and test-retest reliability of the constructs assessed by the PEERS Measure. The Cronbach's alpha for the bullying scale (4 questions measuring different forms of bullying) was .79; for the victimization scale, the coefficient was .73, and for the positive nominations scale (a combination of peer acceptance, defending and prosocial behavior) it was .85. Test-retest results showed that 72.2% of children gave the same answers to the yes-no questions on victimization, 74.8% gave the same answer to the question on defending, and 86.1% the same answer to the question on prosocial behavior. Pearson's correlation coefficients for peer-nomination scores were high (e.g., for bullying $r=.77$, $p<.001$ and for peer acceptance $r=.79$, $p<.001$). The ICC coefficients showed good agreement between the test-retest scores ($ICC_{\text{bullying}}=.78$, $p<.001$, $ICC_{\text{victimization}}=.67$, $p<.001$, $ICC_{\text{peer rejection}}=.71$, $p<.001$, and $ICC_{\text{peer acceptance}}=.81$, $p<.001$).

To assess the agreement between the test-retest scores, we also examined the Bland-Altman plot, where the mean of the differences for bullying scores from two assessments was close to zero, thus reflecting good agreement (mean= 0.00, lower limit of agreement = -0.01, upper limit of agreement = 0.09). There was also good agreement for victimization scores (mean=0.00, lower limit of agreement = -0.15, upper limit of agreement = 0.15).

Self-reported victimization and peer nominations

Before each peer-nomination question on victimization, the children answered four 'yes/no' questions on different forms of victimization. In total, 38.7% reported being bullied verbally by their classmates, 19.3% reported having experienced bullying that was expressed by taking away or breaking their things or belongings, 39.1% reported being victimized physically, and 38.5% reported that they had experienced relational victimization. Girls reported a higher frequency of relational victimization (43.5% vs. 33.5%, $p<.001$), verbal victimization (40.8% vs. 36.7%, $p=0.02$) and material victimization (21.6% vs. 17.0%, $p=.001$). Both genders reported a similar frequency of physical peer victimization.

Next, we examined the *peer-nomination scores*. Correlations among peer acceptance, peer rejection, defending, prosocial behavior and bullying were all statistically significant. All were in the direction expected (Table 1): for instance, bullying and peer rejection were positively correlated ($r=.51$, $p<.001$); and bullying and prosocial behavior were negatively correlated ($r= -.14$, $p<.001$). The most strongly associated were defending and prosocial behavior ($r=.71$, $p<.001$), peer acceptance and defending ($r=.61$, $p<.001$), and peer acceptance and prosocial

Table 1 Inter-correlations between peer-nomination scores

Peer-nomination scores	Peer rejection	Peer acceptance	Prosocial behavior	Defending	Victimization
Bullying	.51***	-.08***	-.14***	-.01	.26***
Peer rejection		-.38***	-.34***	-.25***	.22***
Peer acceptance			.66***	.61***	-.08***
Prosocial behavior				.71***	-.04*
Defending					-.03

Note. $N=4017$. Peer-nomination scores were based on ratings by multiple peers.

* $p<.05$, ** $p<.01$, *** $p<.001$

behavior ($r=.66$, $p<.001$). The results showed that children who behave prosocially towards others also defend their classmates if they are bullied, and are more accepted by their peers.

We determined how many children nominating bullies gave the maximum number of nominations allowed, and found that 4.8% gave the maximum number allowed for verbal victimization, 2.7% gave the maximum for physical victimization, 1.4% gave the maximum for material victimization, and 3.9% for relational victimization.

Table 2. Gender differences in peer-nomination scores

Peer-nomination scores	Boys $N=1998$ (M, SD)	Girls $N=2019$ (M, SD)	p -value	η^2
Reported by peers				
Bullying others:	0.08 (0.07)	0.05 (0.04)	$p<.001$	0.07
Verbal bullying	0.10 (0.10)	0.06 (0.07)	$p<.001$	0.06
Material bullying	0.04 (0.05)	0.02 (0.04)	$p<.001$	0.03
Physical bullying	0.10 (0.10)	0.03 (0.05)	$p<.001$	0.13
Relational bullying	0.07 (0.07)	0.07 (0.07)	n.s.	0.001
Peer rejection	0.22 (0.16)	0.17 (0.14)	$p<.001$	0.02
Positive nominations:	0.15 (0.08)	0.17 (0.09)	$p<.001$	0.01
Peer acceptance	0.22 (0.14)	0.22 (0.14)	n.s.	0.0003
Prosocial behavior	0.17 (0.11)	0.23 (0.13)	$p<.001$	0.06
Defending	0.14 (0.10)	0.17 (0.11)	$p<.001$	0.01
Self-report				
Victimization:	0.06 (0.09)	0.07 (0.09)	$p<.001$	
Verbal victimization	0.07 (0.13)	0.09 (0.14)	$p<.01$	
Material victimization	0.02 (0.08)	0.03 (0.08)	$p<.05$	
Physical victimization	0.06 (0.11)	0.07 (0.11)	n.s.	
Relational victimization	0.06 (0.12)	0.08 (0.13)	$p<.001$	

Note. $N=4017$. Peer-nomination scores were based on ratings by multiple peers.

Values presented are mean and standard deviation.

P -values are derived from analysis using robust standard errors (Huber-White sandwich method) in order to adjust for the clustered structure of the data.

Table 2 presents the gender differences in *peer-nomination scores*, and shows that boys and girls received a similar number of nominations for relational bullying. Unlike boys, who were more often rejected by classmates and were more often nominated as bullies, girls received more positive nominations. Girls were nominated more often than boys as defenders and as behaving prosocially towards others. With regard to peer acceptance, peer nominations showed no gender differences. The number of given-out nominations showed that girls had higher relational, verbal and material victimization scores. We found no gender differences with regard to physical victimization scores.

Consistency of peer report with other measures

We examined the consistency of peer-reported bullying with other measures of behavioral problems. During the administration of the PEERS Measure we had been unable to collect additional measurements of bullying – such as observations of peer interactions or teacher reports of bullying – at the same time as collecting the PEERS data. We therefore compared peer reports of bullying with two other measures available in the Generation R Study: teacher-reports of aggressive behavior, and child self-report of aggressive behavior. These teacher-reports and child self-reports of aggression were related to the bullying data obtained with the PEERS Measure. These additional assessments were carried out independently of the PEERS Measure – at a different time, by different observers, and using different methods (i.e., self-report by child interview and mailed teacher questionnaires). We examined the correlation between the peer-reported bullying and teacher report of aggression on the TRF *Aggressive Behavior* scale. The correlations between the two was .32 ($p < .001$). As Table 3 shows, the correlations became stronger when the interval between the assessments was shorter (i.e., $r = .42$, $p < .001$). The correlation between aggression reported by a child in the BPI interview and

Table 3 Correlations between peer, teacher and child reports

Child's bullying score based on classmates' nominations (PEERS Measure)	Aggressive behavior	
	Teacher report (TRF)	Child report (BPI)
	<i>r</i> (N)	<i>r</i> (N)
Bullying	.37*** (1160)	.27*** (1330)
Bullying (time between assessments <10 months ¹)	.42*** (460)	.37*** (210)
Bullying (time between assessments ≥10 months ²)	.32*** (700)	.24*** (1120)

Note.

Teacher report was obtained using the Teacher Report Form ($n=1160$). Child interviews were conducted using the Berkeley Puppet Interview ($n=1330$). Peer-nomination scores were based on ratings by multiple peers.

¹Analyses conducted in the group of children for whom the time interval between the assessments was < 10 months.

²Analyses conducted in the group of children for whom the time interval between the assessments was ≥ 10 months.

Values presented are Pearson's correlation coefficients.

* $p < .05$, ** $p < .01$ *** $p < .001$.

peer-reported scores of bullying was .27 ($p < .001$). We also examined the correlation coefficients between the scores from the BPI and the PEERS Measure that were carried out closer in time (Table 3). Again, the correlations between child-reported aggression and peer-reported bullying was stronger in the group of children with a shorter interval between the interviews and the PEERS Measure ($r = .37, p < .001$).

Lastly, we examined the associations of the child and maternal socio-demographic characteristics with bullying and victimization scores obtained by the PEERS Measure (Table 4). Children of non-Western extraction were more likely to be nominated as bullies and to report more bullying and victimization than children of Dutch national origin (e.g., the mean score for bullying in Dutch children was 0.04 ($SD = 0.05$), and the bullying score in children of non-Western extraction was 0.07 ($SD = 0.06$), $p < .001$).

Some additional analyses involved further examination of the differences in bullying and victimization scores among children of non-Western extraction. The bullying scores in children of Dutch national origin were significantly lower than those in Moroccan and Turkish

Table 4. Child and maternal socio-demographic characteristics and bullying involvement

Sociodemographic characteristics	N	Bullying (M, SD)	p*	N	Victimization (M, SD)	p*
Child's age	1590	7.64 (9.12)	<.001	1552	7.68 (9.12)	<.01
Gender						
Boy	777	0.07 (0.06)	Ref	758	0.06 (0.09)	Ref
Girl	813	0.04 (0.04)	<.001	794	0.06 (0.08)	n.s.
Child's national origin:						
Dutch	895	0.04 (0.05)	Ref	874	0.05 (0.07)	Ref
Other Western	161	0.05 (0.04)	n.s.	161	0.06 (0.10)	n.s.
Non-western	462	0.07 (0.06)	<.001	447	0.07 (0.09)	<.001
Mother's education:						
Low	258	0.07 (0.07)	<.001	246	0.08 (0.11)	<.001
Low intermediate	427	0.06 (0.06)	<.001	414	0.06 (0.09)	<.05
High intermediate	336	0.04 (0.04)	n.s.	333	0.05 (0.07)	n.s.
High	399	0.04 (0.04)	Ref	393	0.04 (0.07)	Ref
Income:						
Below social-security level: <€1200 (approx. US \$1500)	177	0.07 (0.06)	<.001	169	0.08 (0.10)	<.001
Average: €1200 to €2000 (approx. US \$1500-\$2500)	220	0.06 (0.06)	<.001	213	0.06 (0.09)	<.05
Modal income: > €2000 (approx. US \$2500)	796	0.04 (0.04)	Ref	784	0.04 (0.07)	Ref
Marital status						
Married/living together	1255	0.05 (0.05)	Ref	1229	0.05 (0.08)	Ref
Single	165	0.07 (0.06)	<.001	158	0.08 (0.11)	<.01

Note. Values presented are mean and standard deviation. Peer-nomination scores were based on ratings by multiple peers.

*P-values are derived from regression analyses adjusted for the clustered structure of the data. Ref = reference category.

children and in other children of non-Western extraction (e.g., Cape Verdeans and Dutch Antilleans). Children of Moroccan, Surinamese and other non-Western extraction also had higher victimization scores. However, after adjustment for the child and maternal socio-demographic covariates presented in Table 4, the only bullying scores that remained statistically significant were those for children of Moroccan extraction; those in victimization were no longer statistically significant. Bullying and victimization scores were both higher in children born to mothers with a low intermediate or low educational level (Table 4). Children living in households with lower net monthly income and children of single mothers scored higher on bullying and had higher victimization scores. Supplementary Table 1 shows that mutual adjustment and an additional adjustment for the indicators of family structure (e.g., child birth-order) and cultural background (e.g., maternal national origin) reduced the number of factors associated with involvement in bullying. Four variables remained statistically significantly associated with bullying: child age and gender, maternal national origin, and maternal educational level. We also examined correlation between maternal age and children's bullying and victimization scores. Maternal age was negatively correlated with bullying scores ($r = -.20, p < .001$) and victimization scores ($r = -.13, p < .001$).

DISCUSSION

In this study we evaluated the psychometric properties of the PEERS Measure, a computerized instrument that takes a novel approach to using the peer-nomination method with elementary school children in grades 1-2 to assess children's bullying involvement. Children are helped with the peer-nomination process by illustrations and audio instructions; the assessment is made appealing by its animated and interactive features. By combining the individual reports of multiple peers, the PEERS Measure obtains reliable information on peer acceptance, peer rejection, bullying, defending and prosocial behavior from the perspective of the entire group. Whereas most previous research was carried out with older children and used questionnaires or interviews, our study demonstrates how a dyadic peer-nomination method embedded in an age-appropriate computerized instrument can be used with young children.

Occurrence of victimization

The PEERS Measure is developed to assess bullying and peer relations from a group perspective. As measured by this instrument, bullying involvement reflects the extent to which each child is perceived as a bully by the rest of his or her peers. However, it does not necessarily reflect the prevalence or severity of bullying. The percentages of self-reported victimization obtained using our instrument were rather high (range 19% – 37%), especially relative to the prevalence reported in studies of older children. For example, in a large study of 11-16 year old children across 25 countries, approximately 10% reported involvement in bullying

as bullies, and about 11% reported their involvement as victims (Nansel et al., 2004). In the case of our study, however, two factors deserve particular consideration: the young age of children, and the lack of a specific time-frame in our definition of bullying. The high percentages of victimization reported using our instrument may be attributed to the specifics of the peer relationships at young age: earlier research also found a higher prevalence of bullying involvement in younger children (Boulton & Underwood, 1992). For example, in their study of kindergarten children, Kochenderfer & Ladd (1996) reported percentages of victimization ranging from 42% to 54%. Although the children participating in our study were given a clear definition of bullying, we did not specify a time-frame (other than “often”). This differed from survey studies among older children that defined bullying involvement only if it occurred more than twice during the current term (Nansel, et al., 2004; Solberg & Olweus, 2003). Because, at an early age, children’s comprehension of the concept of time is not fully developed (Siegler & Richards, 1979), first-grade children may find it difficult to make precise time distinctions over recent months. Instead, the PEERS Measure emphasized the intentional and repeated nature of the aggressive acts that typify bullying. As children may therefore have reported their overall experience with peers, this may have contributed to the high rates of self-reported victimization.

The interrelationships between the constructs of the PEERS Measure

Examination of the peer-nomination scores obtained with the PEERS Measure showed that children who are positively evaluated by their peers (i.e., nominated as defenders or as those who behave prosocially towards others) are the most popular children – in other words, those who are most accepted by their peers. Most of the children, who were involved in bullying, either as bullies or victims, were rejected by their peers, or were not nominated in questions about positive behaviors, such as peer acceptance, defending or behaving prosocially towards classmates.

The patterns of peer relationships we found are consistent with earlier research showing associations between constructs such as defending and peer acceptance (Sainio, Veenstra, Huitsing, & Salmivalli, 2011; Salmivalli, et al., 1996), bullying and peer rejection (Boulton & Smith, 1994), and victimization and peer acceptance (Boulton & Underwood, 1992; Kochenderfer & Ladd, 1997).

Reliability and consistency of the PEERS Measure

High correlation coefficients and ICC coefficients between the test-retest measures suggest that the PEERS Measure has good reliability. Like our own findings, the study of Kochenderfer and Ladd (1997) reported only a moderate correlation between test-retest assessments of peer victimization. The young age of our participants and the interval of 3 months between the test-retest data collection should also be borne in mind. Altogether, the test-retest results demonstrated that the instrument had sufficient reliability.

In the behavioral sciences, the correlations between the reports of different informants on the same construct are typically low (Achenbach, McConaughy, & Howell, 1987; Laird & De Los Reyes, 2012). A meta-analysis of 269 samples in 119 studies using concurrent assessments and the same instruments reported an r of .44 between peer-reported and teacher-reported behavioral problems, and an r of .26 between peer-reports and child-reports of behavioral problems (Achenbach, et al., 1987). Also, a study by Perren and Alsaker (2006) that is similar to ours reported a correlation between teacher-reports and peer-reports on victimization of r .08, and on reports of bullying of r .23. Thus, the correlations we report between the peer-reported bullying scores obtained with the PEERS Measure and teacher (r =.42) and child (r =.37) reports of aggressive behavior are acceptable, and well within the range that can be expected if different informants' reports are used. Although the interval between these data collections and the use of different instruments might have resulted in somewhat lower correlations than one might otherwise expect, we showed that the correlations between the constructs were stronger once we correlated data with a shorter interval between the data collections. Also, teachers' limited awareness of the peer interactions (Atlas & Pepler, 1998; Craig, Pepler, & Atlas, 2000), as compared to the peers, may have influenced the correlation between the peer- and teacher-reports.

Child and maternal socio-demographic characteristics and the PEERS Measure

Children's bullying experiences within a school context are influenced by several important factors, including gender, child ethnicity and family socioeconomic background. As girls are more frequently involved in indirect forms of bullying, and are also more likely to be victims of relational aggression, involvement in specific forms of bullying differs according to gender (Crick & Grotpeter, 1995; Jimerson, et al., 2010).

In the context of cross-gender and same-gender bullying involvement, gender is important. For instance, children often choose to bully same-sex classmates who are rejected by other same-sex classmates (Veenstra, Lindenberg, Munnikma, & Dijkstra, 2010). Also, boys and girls differ in their responses to bullying: boys are more likely to react by "fighting back," and also have different ideas with regard to the resolution of bullying. Girls are more likely to suggest "changing the bully" or "helping the victim", unlike boys, who are more likely to "punish the bully" (Jimerson, et al., 2010). Gender differences are also important to intervention in bullying incidents. While both genders intervene equally often to stop bullying, and do so equally successfully, boys tend to intervene more in bullying incidents among boys, and girls to intervene more in incidents among girls (Hawkins, et al., 2001).

The gender differences reported in our study are consistent with earlier research findings that demonstrated more bullying involvement in boys (Boulton & Smith, 1994; Boulton & Underwood, 1992; Salmivalli, et al., 1996), more peer rejection towards boys (Dijkstra, Lindenberg, & Veenstra, 2008; Veenstra et al., 2008), and more positive nominations for girls (Salmivalli, et al., 1996). Our study was also consistent with previous studies in older children, and

with studies using other instruments which found that girls are often victimized relationally (Crick & Grotpeter, 1996; Dukes, Stein, & Zane, 2010): in our study, girls had somewhat higher scores of relational victimization than boys.

Ethnicity is another important factor related to children's bullying experiences. For example, studies in Finland and the Netherlands showed that immigrant children and ethnic-minority groups are more often involved in bullying (Strohmeier, Karna, & Salmivalli, 2011; Vervoort, Scholte, & Overbeek, 2010). Bullying and victimization related to immigrant, ethnic or racial characteristics may be underlain by children's being different from the situationally "dominant" group (Jimerson, et al., 2010). In the Netherlands, some of the largest minority ethnic groups are Turkish, Moroccan and Surinamese. A study of 10 to 13-year olds in the Netherlands showed that ethnic-minority children underwent more victimization at school than Dutch ones (Verkuyten & Thijs, 2002). Another study among 5 to 6-year olds in the Netherlands showed that most non-Dutch ethnic-minority children were more likely to be involved in bullying than Dutch children (Jansen, et al., 2013). In line with earlier research (Jansen, et al., 2013; Veenstra et al., 2005; Verkuyten & Thijs, 2002), we found that children of non-Western extraction were more likely to be involved in bullying and to be victimized.

Bullying involvement is related to family socioeconomic background. Parents' income and educational level are important indicators of a family's socioeconomic status, and it has been shown that children from lower socioeconomic status families are more likely to be involved in bullying, especially those with a single parent and parents of a low educational level (Jansen, et al., 2012). Possible mechanisms explaining the relation between these factors and involvement in child bullying may be attributable to the parental knowledge, skills, norms and values that are transferred to a child during its upbringing. The effect of single parenthood may be explained by limited parent-child interactions, less parental control, and less time or fewer opportunities to address the child's possible difficulties in peer relationships (Jansen, et al., 2012). In our study, factors such as maternal age, lower income, lower educational level and marital status (i.e., being single), were related to more involvement in bullying. These findings are also consistent with the findings of earlier studies in older children, which found that children of single parents and of parents with a lower education and a lower family income are more likely to be involved in bullying (Due et al., 2009; Nordhagen, Nielsen, Stigum, & Köhler, 2005; von Rueden et al., 2006). In sum, our data show that the child and maternal characteristics associated with bullying and victimization scores obtained with the PEERS Measure are similar to those reported in earlier studies.

Study limitations

In our view, our study has four potential limitations. First, socio-demographic data, the Berkeley Puppet Interviews, and the TRF data were available for only part of our sample, i.e., children participating in the Generation R Study (Jaddoe, et al., 2010). This may suggest that this

information was available only for a selective group of children. However, substantial variations in all socio-demographic characteristics remained.

The second potential weakness is that the definition of bullying we gave to children did not explicitly use the term “power imbalance” and did not describe the victim as being “weaker” and a bully as “stronger”. Young children tend to associate these concepts primarily with physical strength, while power imbalances can also result from other characteristics of a bully, such as popularity. When describing bullying incidents we therefore emphasized victim’s struggle and inability to defend him/herself or to stop bullying, thereby implying the power imbalance between bully and victim.

The third weakness was that we operationalized the concept of relational bullying as social exclusion. As the concept of relational bullying is broader, and includes activities such as manipulating friendships or spreading rumors (Crick & Groetpeter, 1996), our findings have to be interpreted using a rather narrow operationalization of this concept.

The final potential limitation of our study concerns our use of photos of the interactions between peers that were used as illustrations of the questions in the PEERS Measure. The actors were children of the same age as our target population, and showed white children of both genders for different illustrations. We acknowledge that children’s reports may have been influenced by the actors’ physical appearance (e.g., age, gender). Several earlier studies used stick-figures (Monks & Smith, 2006; Smith, et al., 2002) when describing bullying. These are more neutral and minimize any effects of physical appearance. However, we anticipated that using stick-figures in order to describe less overt types of bullying (such as verbal bullying or social exclusion) to young children could have been ambiguous. To describe different forms of peer interaction, we therefore used actors with neutral physical characteristics.

Other important methodological considerations

As the prevalence of bullying involvement is highest in elementary school grades 1-2 (Karna, et al., 2011), identifying bullying in the first grades of elementary school is key to the primary and secondary prevention of bullying and victimization. In other words, it is crucial to detect bullying problems early, and to intervene early in the school curriculum. In our view, the development of the PEERS Measure can help to assess bullying involvement and peer relations among young children. We also believe that, directly or indirectly, all the parties involved in our study benefited from their participation: after the PEERS Measure, teachers at the participating schools were given tailored reports containing general findings at class level, and an information package on bullying, its detection and prevention. Participation in the study enhanced teachers’ knowledge about peer relationships in the class, and teachers’ awareness of bullying.

Another issue that should be considered here is the use of passive consent. In this study, obtaining it improved the feasibility of the large-scale data collection we required. The consent procedure ensured the high participation rates per school class that are crucial to the use

of sociometric methods such as peer nomination. But while the passive-consent procedure was used to test the feasibility of the PEERS Measure in the Netherlands, different regulations may not always allow the use of such procedures in other countries. Nonetheless, even in situations where passive consent cannot be used, we anticipate no difficulties with the use of the instrument in situations where active consent must be obtained.

The PEERS Measure treats the entire school class as a source of information on who bullies whom. For this method a high participation rate is crucial. In school-based research, an active consent procedure may result in lower response rates and more selection bias than a passive consent procedure (Anderman et al., 1995; Ellickson & Hawes, 1989; Esbensen, Miller, Taylor, He, & Freng, 1999; Esbensen et al., 1996; Pokorny, Jason, Schoeny, Townsend, & Curie, 2001; Tigges, 2003). A reduced participation rate can limit the identification of bullies and victims. Nevertheless, even when active consent is used, the participation rates can be raised to an acceptable level by researchers' multiple and extensive follow-up efforts; however, these additional efforts tend to be rather costly and time-consuming (Ellickson & Hawes, 1989; Johnson et al., 1999). Importantly, as long as a high participation rate is reached (e.g. $\geq 70\%$) the risk of bias can be minimized (Eaton, Lowry, Brener, Grunbaum, & Kann, 2004).

A possibility of selective non-response is a potential drawback of every observational study. Children who do not receive parental consent to participate in the study may be more likely to have problematic peer relationships (Beck, Collins, Overholser, & Terry, 1984; Frame & Strauss, 1987). This could pose a challenge for identification of bullies in a class. However, it is unlikely that this has impacted our results, as in the school-based research the use of passive consent procedure usually results in a relatively unbiased sample (Hollmann & McNamara, 1999). Furthermore, in our study, only 1.7% of children (across 190 school classes) did not participate as a result of their parents refusing to allow participation.

The PEERS Measure assesses peer relationships in a class setting and the nominations are restricted to the (participating) children from the same class. Using this measure to identify bullying outside the class was not feasible, especially at this young age. However, at young age, most of the bullying/victimization occurs among children from the same class (Beaty & Alexeyev, 2008; Wolke, Woods, Stanford, & Schulz, 2001), and thus this measure can be effectively used to identify bullying to the extent that it occurs within a class.

In some countries it may be difficult to use photos of children, due either to local regulations or to parental reluctance to provide their consent. In such cases, an alternative way to use the peer-nomination method with young children whose reading skills are not good enough for the use of peer-nomination questionnaires would be through interviews.

Our purpose in describing the child and maternal socio-demographic correlates of bullying involvement obtained with the PEERS Measure lay in our desire to examine the consistency of these associations with earlier findings. We did not intend to use various child and maternal characteristics to predict bullying or victimization, or to infer any causal associations. To examine these associations, future studies aiming to identify predictors of bullying involve-

ment in young children could use longitudinal designs, adjusting the association for possible confounders, such as children's language ability, working memory and cultural background.

As technology and the social media are becoming increasingly important in the lives of children and adolescents, future research should bear in mind that the nature of bullying is changing: as it adopts new forms – such as through email, text messages, or the social media – children can become even more accessible to bullying (O'Keeffe, Clarke-Pearson, Council on, & Media, 2011). The increase in cyberbullying is likely to affect the prevalence rates of bullying or a child's perception of its severity. As cyberbullying is an increasing problem among children older than our study participants, this problem should be addressed in research focusing on bullying among adolescents.

In summary, our findings suggest that the PEERS Measure is a reliable and age-appropriate instrument that can be used to collect dyadic/network data as early as the first grades of elementary school. It is therefore a suitable alternative to common methods such as interviews and live observations.

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SUPPLEMENTARY MATERIAL

Table S1. Mutually Adjusted Child and Maternal Characteristics and Bullying Involvement

Sociodemographic characteristics	Bullying (M, SD)	p*	Victimization (M, SD)	p*
Age of the child	7.64 (9.12)	0.02	7.68 (9.12)	0.001
Gender				
Boy	0.07 (0.06)	Ref	0.06 (0.09)	Ref
Girl	0.04 (0.04)	<0.001	0.06 (0.08)	0.94
<i>Indicators of cultural background</i>				
National origin of the child:				
Dutch	0.04 (0.05)	Ref	0.05 (0.07)	Ref
Other Western	0.05 (0.04)	0.37	0.06 (0.10)	0.20
Non-Western:	0.07 (0.06)	0.41	0.07 (0.09)	0.12
National origin of the mother				
Dutch	0.04 (0.04)	Ref	0.05 (0.07)	Ref
Other Western	0.05 (0.05)	0.59	0.05 (0.07)	0.18
Non-Western:	0.08 (0.06)	0.001	0.08 (0.10)	0.09
<i>Indicators of socioeconomic status</i>				
Education of the mother:				
Low	0.07 (0.07)	<0.001	0.08 (0.11)	0.93
Mid-low	0.06 (0.06)	<0.001	0.06 (0.09)	0.72
Mid-high	0.04 (0.04)	0.88	0.05 (0.07)	0.93
High	0.04 (0.04)	Ref	0.04 (0.07)	Ref
Income:				
Below social security level: <€1200	0.07 (0.06)	0.25	0.08 (0.10)	0.22
Average: €1200 to €2000	0.06 (0.06)	0.44	0.06 (0.09)	0.28
Modal income: >€2000	0.04 (0.04)	Ref	0.04 (0.07)	Ref
<i>Indicators of family structure</i>				
Marital status				
Married/living together	0.05 (0.05)	Ref	0.05 (0.08)	Ref
Single	0.07 (0.06)	0.07	0.08 (0.11)	0.55
Birth order:				
First-born	0.05 (0.05)	Ref	0.05 (0.08)	Ref
Older siblings in the family	0.06 (0.06)	0.73	0.06 (0.09)	0.06

Note. Values presented are means and standard deviations. Peer nomination scores were based on ratings by multiple peers.

**p*-values are derived from regression analyses adjusting for clustered nature of the data.

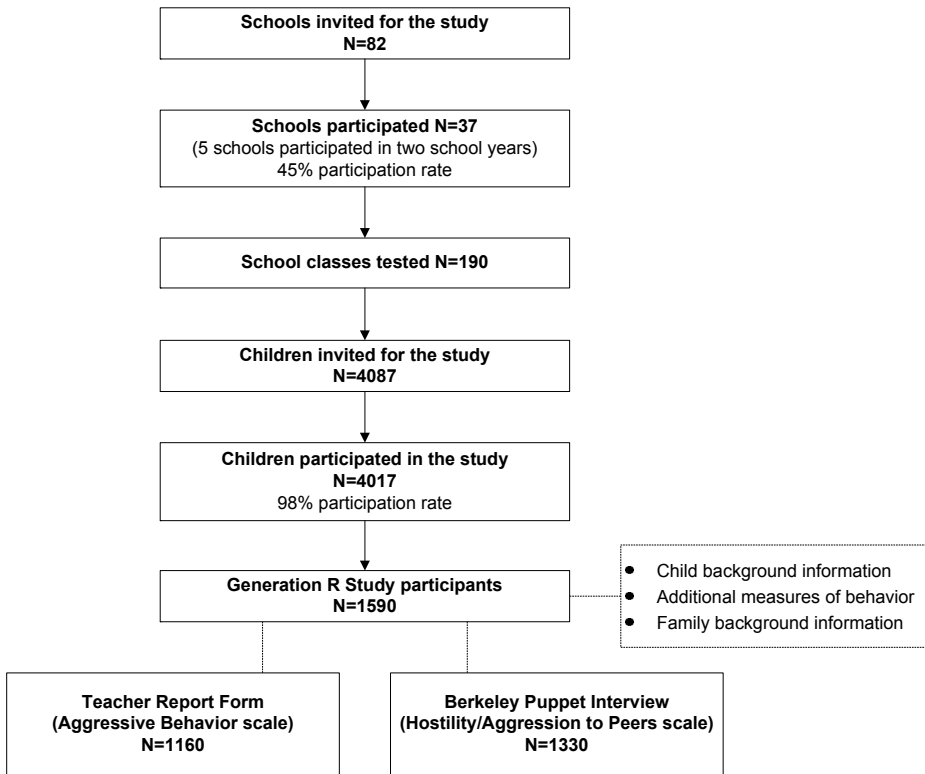


Figure S1. Flow-chart of the sampling procedure

Instructions Prior to the Start of the PEERS Measure^b

You will now be asked to do an interesting computer task. This task is about friendships and bullying. You will have to answer different questions about yourself and your classmates. It is important that you listen very carefully to all the questions. You should answer honestly; you should tell about things in the way they really are. It is important that you are sure about your answers. The questions in this task are about children at school. Many children have got friends in their class but sometimes it can also happen that some children get bullied. Bullying means that one child offends another child time after time and that he/she does that on purpose. The child that is bullied doesn't like it but often doesn't know how to stop it. If something not nice happens only once, or when it happens by accident then it is not bullying. Also when, for example, two friends are teasing each other a bit in a friendly way, then it is not bullying, because both of them are playing and enjoying it. So, bullying is when a child does something not nice to another child time after time and on purpose, and the child that is bullied doesn't really know how to stop it.

Bullying can be different. I have got some pictures to show and explain this to you. Bullying can, for example, be like this (*show the first picture*), that's when one child does something painful to another child, like for example hitting or pushing (*show the picture from the PEERS Measure*). It can also be like this (*show the next picture from the instructions book*), that's when one child takes away, breaks or hides another child's things. Bullying can also happen when a child says ugly and mean things to another child, laughs at that child or calls him/her names (*show illustration of verbal bullying*). And do you see on this picture (*show the photo closer*) that this child really doesn't like it, the child is upset and looks down? And here you see two children who are going to play together and this other girl wants to play with them (*point*), but these two children do not allow her to play with them. Do you know how this kind of bullying is called? (*Wait for the children to answer*). Yes, correct, it's called excluding someone. Indeed. This is when children leave out another child of activities time after time and do not let him/her play with them.

The PEERS Measure Questions^c

Transcript of the audio "Peer acceptance":

On a screen a child sees a school bus arriving. A child hears: "Look, there is a school bus and you are the driver! (a child's photo can be seen at the driver's seat). You are going on a nice

^b The information presented here is an example of a part of the protocol. The entire protocol is not presented here. Technical instructions are omitted for reasons of brevity.

^c Only parts of the transcript of the audio from the PEERS Measure are presented here as an example of the phrasing of the questions. The following parts of the audio were omitted for reasons of brevity: "Introduction" and "Familiarization task".

school trip to a zoo! And here are your classmates (photos of all the participating children are displayed). You can choose whom you would really like to come with you! Who would you like the most to go with you on the trip? Click on the photos of the children you would like to come with you. When you've finished, click on the green arrow!"

Transcript of the audio "Peer rejection":

On a screen a child sees the school bus and the photos of the nominated children (i.e., accepted peers) are seen through the windows, seated in the bus. A child hears: *"Oh this trip is really fun! But unfortunately it's not possible to take everybody along. Whom would you rather not take with you on the trip? Click on their photos. As soon as you are done and ready to go, click on the green arrow!"* Once a child clicks on the green arrow, the bus drives away and a child hears children singing a song and sees the bus driving through the streets. The bus stops at school. The part of the assessment where questions about bullying, defending and prosocial behavior are asked begins when children see a classroom.

Transcript of audio "Verbal bullying":

A child sees a picture of verbal bullying on the screen and hears the following:

"You know, some children are not very nice to other children, just as you can see on this picture. Have a look. They are saying mean things to this boy; they are calling him names. This is not the first time they are doing this; they've been often saying ugly things to him. They are doing this on purpose and this boy feels like he cannot do much about it. Does anyone in your class do such things to you?" Two animated icons appear on the screen (one, a 'yes-icon', is nodding for 'yes' and the second one, a 'no-icon', is shaking head for 'no'). A child hears the following: *"Click on the yes-nodding icon if someone in your class often says mean or ugly things to you. Click on the no-shaking icon if no one in your class says mean or ugly things to you."* If a child clicks on 'no', then the next question of the PEERS Measure follows. If a child clicks on 'yes', then a child sees the photos of the classmates and hears the following: *"Click on the pictures of those classmates who often say mean things to you. You can't click on more than 10 photos. If the photo of a classmate you want to choose is not there, click on the empty picture underneath. When you've finished, click on the green arrow to go further."* When a child clicks on the green arrow, the next question of the PEERS Measure follows.

Transcript of audio "Material bullying":

A child sees a picture of material bullying on the screen and hears the following:

"Oh look at this, her things are being taken away from her! Sometimes he hides her things and once he also broke something that belonged to her. She is really upset about that. He takes her things away from her on purpose and she finds it very difficult to do something about it. Does anyone in your class often do such things to you?" Two animated icons appear on the screen (one, a 'yes-icon', is nodding for 'yes' and the second one, a 'no-icon', is shaking head for 'no'). A child

hears the following: *“Click on the yes-nodding icon if someone in your class often takes away your things from you, hides your things, damages or breaks them. Click on the no-shaking icon if no one in your class does such things to you.”* If a child clicks on ‘no’, then the next question of the PEERS Measure follows. If a child clicks on ‘yes’, then a child sees the photos of the classmates and hears the following: *“Click on the pictures of those classmates who often take away things from you, hide them or break them. You can’t click on more than 10 photos. If the photo of a classmate you want to choose is not there, click on the empty picture underneath. When you’ve finished, click on the green arrow to go further.”* When a child clicks on the green arrow, the next question of the PEERS Measure follows.

Transcript of audio “Physical bullying”:

A child sees a picture of physical bullying on the screen and hears the following:

“Oh do you seen that? That child is being pushed by the classmate. This happens quite often; they often hit, kick or push him. He finds it very difficult to do something about it. Does anyone from your class often do such things to you: hit, kick or push you?” Two animated icons appear on the screen (one, a ‘yes-icon’, is nodding for ‘yes’ and the second one, a ‘no-icon’, is shaking head for ‘no’). A child hears the following: *“Click on the yes-nodding icon if someone in your class often hits, kicks or pushes you. Click on the no-shaking icon if no one in your class does such things to you.”* If a child clicks on ‘no’, then the next question of the PEERS Measure follows. If a child clicks on ‘yes’, then a child sees the photos of the classmates and hears the following: *“Click on the pictures of those children who often do such things to you. You can’t click on more than 10 photos. If the photo of a classmate you want to choose is not there, click on the empty picture underneath. When you’ve finished, click on the green arrow to go further.”* When a child clicks on the green arrow, the next question of the PEERS Measure follows.

Transcript of audio “Relational bullying (i.e. social exclusion)”:

A child sees a picture of relational bullying (social exclusion) on the screen and hears the following: *“Oh have a look! This child is not allowed to play along with them. She is often left out of things by these classmates. Also, they often say that she is not allowed to sit close by. Do children in your class often do such things to you? Do not allow you to play with them or to sit with them?”* Two animated icons appear on the screen (one, a ‘yes-icon’, is nodding for ‘yes’ and the second one, a ‘no-icon’, is shaking head for ‘no’). A child hears the following: *“Click on the yes-nodding icon if someone in your class often says that you are not allowed to play with them or to sit with them. Click on the no-shaking icon if no one in your class does such things to you.”* If a child clicks on ‘no’, then the next question of the PEERS Measure follows. If a child clicks on ‘yes’, then a child sees the photos of the classmates and hears the following: *“Click on their pictures. You can’t click on more than 10 photos. If the photo of a classmate you want to choose is not there, click on the empty picture underneath. When you’ve finished, click on the green arrow to go further.”* When a child clicks on the green arrow, the next question of the PEERS Measure follows.

Transcript of audio “Defender’s role”:

A child sees a picture of a child being defended on the screen and hears the following: *“When children behave mean to another child it’s called bullying. There are also children who try to help a bullied child – have a look. Here you can see that a child in the middle stops the bully and says that he should not bully his classmate. Another way to stop bullying is to go and tell the teacher about what is happening. Are there children in your class who would help you if you get bullied?”* Two animated icons appear on the screen (one, a ‘yes-icon’, is nodding for ‘yes’ and the second one, a ‘no-icon’, is shaking head for ‘no’). A child hears the following: *“Click on the yes-nodding icon if someone in your class would help you if you get bullied. Click on the no-shaking icon if no one in your class would help you if you get bullied.”* If a child clicks on ‘no’, then the next question of the PEERS Measure follows. If a child clicks on ‘yes’, then a child sees the photos of the classmates and hears the following: *“Click on the pictures of those classmates who would help you if you are bullied. You can’t click on more than 10 photos. If the photo of a classmate you want to choose is not there, click on the empty picture underneath. When you’ve finished, click on the green arrow to go further.”* When a child clicks on the green arrow, the next question of the PEERS Measure follows.

Transcript of audio “Prosocial behavior”:

A child sees a picture of prosocial behavior on the screen and hears the following: *“You probably also know children who are kind and nice to other children. They often share things with others, or they comfort a classmate who is sad, just like you see on this picture. Does anyone in your class do such nice things for you?”* Two animated icons appear on the screen (one, a ‘yes-icon’, is nodding for ‘yes’ and the second one, a ‘no-icon’, is shaking head for ‘no’). A child hears the following: *“Click on the yes-nodding icon if someone in your class does such nice things for you. Click on the no-shaking icon if no one in your class does such things for you.”* If a child clicks on ‘no’, then the next part of the PEERS Measure follows. If a child clicks on ‘yes’, then a child sees the photos of the classmates and hears the following: *“Click on the pictures of those classmates who often do nice things for you. You can’t click on more than 10 photos. If the photo of a classmate you want to choose is not there, click on the empty picture underneath. When you’ve finished, click on the green arrow to go further.”* When a child clicks on the green arrow, the next part of the PEERS Measure follows.

Transcript of audio “Ending of the PEERS”:

A child sees the bus arriving to the zoo. A sign ‘the end’ appears on the screen. A child hears: *“Oh there is the zoo already! And you have also finished the computer task. I hope you’ve enjoyed it. I’ve really enjoyed talking to you. You did really well answering all the questions!”*

Figure S2 Illustration of the PEERS Measure



An illustration of a yes-no question about physical victimization



An illustration of a child answering a peer nomination question

Chapter 4

Behind bullying and defending: Same-sex and other-sex relations and their associations with acceptance and rejection

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ABSTRACT

Relatively little is known about bullying and defending behaviors of children in early elementary school. However, this period is crucial for children's development as at this age they start to participate in a stable peer group, and difficulties in social interactions can be detected early by professionals. An interactive animated web-based computer program was used in this study to assess peer relationships among young children. The computerized task was conducted among 2,135 children in grades 1-2 from 22 elementary schools to examine the association of bullying, victimization, and defending with being accepted or rejected. Same-sex and other-sex peer relations were distinguished using dyadic data. Both boys and girls were more likely to accept same-sex classmates than other-sex classmates, and boys were more often nominated than girls as perpetrators of bullying against both boys and girls. It was found that bullies were rejected by those for whom they posed a potential threat, and that defenders were preferred by those classmates for whom they were a potential source of protection. Bullies chose victims who were rejected by significant others, but contrary to expectations, children who bullied boys scored low on peer affection. It is possible that these bullies were not strategic enough to select the "right" targets. Overall, the current findings provide evidence for strategies involved in bullying and defending at early age.

INTRODUCTION

School bullying is common around the world: About 15 percent of children are victimized (Salmivalli & Peets, 2009). Unlike friendly teasing, bullying is long-lasting and unwanted, and implies an imbalance in power (Olweus, 1978). Preadolescent bullies aim to gain social admiration, status, and dominance (Sijtsema, Veenstra, Lindenberg, & Salmivalli, 2009), but they also value peer affection (Veenstra, Lindenberg, Munniksmä, & Dijkstra, 2010) and care about the approval of their own ingroup. Therefore, they strategically choose victims who are unlikely to be defended by other classmates (Sainio, Veenstra, Huitsing, & Salmivalli, 2012; Veenstra et al., 2010). So far, it is unclear whether the same strategies hold in the early school years.

Although the number of studies on bullying among children in early elementary school is increasing (see for a review of studies: Vlachou, Andreou, Botsoglou, & Didaskalou, 2011), relatively little is known about the mechanisms behind bullying in the early school years (up to the age of 8). The early school years, however, are crucial for children. This is the first time when they participate in a stable peer group and where primary prevention can be put into practice if difficulties in social interactions are detected by professionals. Research suggests that the level of bullying is at its highest in grades 1-2 and then declines (Kärnä et al., 2011a). If a goal of an antibullying program is to tackle bullying effectively, it is important to have insight into the processes involved in bullying in that early stage. In this study, we examined the relations of bullying, victimization, and defending with peer acceptance and peer rejection among children in grades 1-2.

This study was focused not only on the negative behaviors of bullying and victimization (Veenstra et al., 2010), but also on the positive behavior of defending. The role of defenders is one of the most important and distinct roles in the work of Salmivalli on bullying as a group process (Salmivalli, Lagerspetz, Björkqvist, Osterman, & Kaukiainen, 1996). Defenders can be used effectively for prevention. For this reason, it is also important to have insight into the processes related to defending.

Because peer processes often show sex segregation (Maccoby, 1998), we argue that in order to better understand the nature of acceptance and rejection, it is important to take into consideration the sex of those involved (referring to the sex of the bully, victim, and defender, and the classmates who accept and reject the bullies, victims, and defenders). This study adds to our knowledge base by examining in a relatively young sample: (1) how bullying, victimization, and defending are related to peer acceptance and rejection among early elementary school children; and (2) whether the examined associations are different for same-sex and other-sex relations.

THEORETICAL ELABORATION

We used a goal-framing approach in this study (Lindenberg, 2001; 2006). Much of human action occurs in the pursuit of goals and, in turn, goals influence people's perceptions and their evaluations of these perceptions. People are aware of the aspects of a situation that may potentially help or hinder their goal pursuit; therefore, they tend to positively evaluate (like) favorable aspects and negatively evaluate (dislike) the hindering aspects of the situation. Liking and disliking are thus the result of different goal-related processes. This goal-framing approach has recently been applied to questions of peer acceptance and rejection in children and adolescents (Dijkstra, Lindenberg, & Veenstra, 2007; Veenstra et al., 2010) and to questions concerning who bullies whom (Huitsing & Veenstra, 2012; Veenstra et al., 2007).

In studies of interactions among children, status and affection goals have been identified as important (Hawley, 2003). The crucial aspect of the pursuit of status is that it is conditioned by the pursuit of affection. People, and certainly children, want to pursue both status and affection (Lindenberg, 1996). For bullying, this means that children who want to dominate will be keenly aware of the opportunities to do so without risking loss of the affection of significant peers (O'Connell, Pepler, & Craig, 1999). Thus, bullies (referring to instrumental and not reactive bullies) are likely to divide the classroom into potential sources of affection (significant others) and potential sources of domination (victims for whom the significant others do not care). A recent study by Huitsing and Veenstra (2012) provided evidence for such ingroup-outgroup processes among 10-year-olds. Bullies are not interested in the opinions of all children in the class, only of those in their ingroup.

Young children's ingroups often consist of children of the same sex (Dijkstra et al., 2007; Martin & Halverson, 1981; Veenstra et al., 2010). From the age of three, children have a preference for same-sex playmates (Maccoby, 1998). Sex segregation is perpetuated by the so-called homosocial norm (Mehta & Strough, 2009). At young ages, liking same-sex peers and spending time with them is considered normative, whereas almost the opposite is true of other-sex relations. As a result, boys are interested in the opinions of other boys with regard to choosing the right victim, and girls are interested in what other girls think. Bullies desire to be accepted by their same-sex mates and do not care about rejection by the rest (Huitsing & Veenstra, 2012; Olthof & Goossens, 2008).

With regard to rejection, the goal-framing theory suggests that bullies will be rejected by their victims and by those for whom they pose a potential threat (referring to those who are of the same sex as the victim). This will not interfere with the bullies' realization of peer affection, because the rejection does not come from significant others. From this follows our first set of hypotheses. We expected that the rejection of bullies would come primarily from the sex to which the victim belonged: (1a) Bullying same-sex classmates is related to being rejected by primarily same-sex classmates; (1b) Bullying other-sex classmates is related to being rejected by primarily other-sex classmates.

In the context of peer affection, goal-framing theory implies that male bullies are likely to strategically choose victims who pose a minimal threat to their realization of peer affection: They choose victims from among those boys who are not preferred (low on acceptance and high on rejection) by other boys. In that way, bullies can gain status by dominating other children while also staying in the good graces of the ingroup. Considering that young children rarely have best friends in the other-sex group, the expectation regarding boys bullying girls was slightly different. Male bullies are likely to choose female victims among those who are rejected by boys; acceptance does not play a role in other-sex relations (Veenstra et al., 2010). For female bullies, we expected the reverse. There is no priori reason to assume that the goals of obtaining peer affection and dominance work differently for girls, other than that there will be fewer girls for whom domination is a prominent goal (Espelage, Mebane, & Adams, 2004; Hanish & Guerra, 2004; Pellegrini, Bartini, & Brooks, 1999; Salmivalli, 2001). From the above, we deduced our second set of hypotheses. We expected that bullies would avoid loss of peer affection by choosing victims who were rejected by significant others: (2a) If children bully same-sex classmates, they choose their potential victims from among children who are low on acceptance and high on rejection by the bullies' same-sex classmates; (2b) If children bully other-sex classmates, they select their potential victims from among those children who are rejected by the bullies' same-sex classmates. Because bullies will try to avoid the loss of affection, we expected that (2c) bullies would not be low on same-sex peer acceptance.

The association between defending and peer acceptance and rejection has been investigated in children aged ten or older (Caravita, Di Blasio, & Salmivalli, 2009; Gini, Albiero, Benelli, & Altoe, 2008; Pöyhönen, Juvonen, & Salmivalli, 2010; Sainio, Veenstra, Huitsing, & Salmivalli, 2011; Salmivalli et al., 1996), but has hardly been considered in the early school years. In the few studies that have been conducted, a positive association was found between defending and peer acceptance, and a negative association between defending and peer rejection (Caravita et al., 2009; Monks, Ruiz, & Val, 2002).

Defenders exhibit prosocial behavior by comforting victimized students. With their behavior, defenders indicate that they care for the victims, which is likely to lead to acceptance by the victims. But are defenders also accepted by bystanders? If so, why would others like defenders? We propose that bystanders like defenders if defending helps bystanders' goal pursuit. If bystanders of bullying identify themselves with the victims, they may also consider themselves potential victims of the bully (compare Huitsing, Veenstra, Sainio, & Salmivalli, 2012; Nishina & Juvonen, 2005). Therefore, bystanders may perceive defenders of victims also as their potential sources of protection in the event of their being victimized. This may explain the likeability of defenders among bystanders. Bystanders might be more likely to identify themselves with same-sex victims (compare Stets & Burke, 2000). Therefore, if bystanders are not the same sex as victims, they are unlikely to feel that they belong to the same group as the victim and subsequently will not feel that the defenders might defend them too. Consequently, bystanders will be less likely to accept the defenders under such conditions. We

deduced our third set of hypotheses, expecting the following: (3a) Defending same-sex victims is primarily related to the social preferences (high on peer acceptance and low on peer rejection) of same-sex classmates; (3b) Defending other-sex victims is primarily related to the social preferences of other-sex classmates.

The hypotheses imply that four major processes are involved in bullying and defending. First, those who reject bullies are the peers who feel most threatened by them. Additionally, among their own sex and across the sexes, bullies choose victims who are rejected by significant others. In this way, bullies aim to avoid being low on acceptance by their ingroup. Finally, defenders are highly accepted by those peers who feel most protected by them.

METHOD

Sample

This study was carried out in collaboration with the Generation R Study (Jaddoe et al., 2010), a large population-based prospective cohort study from fetal life onwards in Rotterdam, the Netherlands. The Generation R study is designed to identify early environmental and genetic causes and causal pathways leading to normal and abnormal growth, development, and health during fetal life, childhood, and adulthood. Data collection in mothers, fathers, and children includes questionnaires, detailed physical and ultrasound examinations, behavioral observations, and biological samples. For a detailed description of the cohort and assessments please see Jaddoe et al. (2010) and Tiemeier et al. (2012).

In this study we used data from a peer assessment among a substantial number of Generation R Study children. At the moment of data collection, the oldest Generation R participants were attending grades 1-2 of elementary school. Schools were selected randomly from the list of schools attended by Generation R Study participants. Schools received a letter with a booklet about the study and were invited to visit the website describing the study and the assessment. Fifty-five elementary schools were invited to participate in the study (Verlinden et al., 2012). Twenty-two schools participated in the 2010-2011 school year, nineteen schools were not willing to participate, and fourteen schools opted to participate at a later moment. The 22 schools that participated in the study had 94 classes and 2,161 children in grades 1-2. The letters and booklets for parents were sent to the teachers at the schools which agreed to participate; they were asked to distribute them to the parents and to inform parents about the upcoming study. Parents were invited to visit a website containing more information about the topic and a demo-version of the assessment instrument. If parents did not want their child to participate, they were asked to inform a teacher or researcher before the assessment. Out of the 2,161 schoolchildren who were invited to participate, the parents of 26 children declined to participate. Therefore, the total sample of the study consisted of 2,135 children (participation rate 99%): 1,072 girls (50.2%) and 1,063 boys (49.8%), with a mean age

of 8.0 years ($SD = 0.8$). The mean class size was 22.7 children ($SD = 4.7$). In total, 861 out of the 2,135 children were participants in the Generation R Study^d.

Peer relationships were assessed during school visits in February – June 2011. Peer nomination data were available for all participating children. Self-reported data were not obtained for 50 children because they were absent from school on the day of the assessment. The study was approved by the Medical Ethics Committee of the Erasmus Medical Centre, Rotterdam the Netherlands (MEC-2010-230).

Instrument

An interactive animated web-based computer program, the PEERS task, was used to assess peer relationships in the early school years (Verlinden et al., 2012). Prior to the assessment, researchers visited the schools in order to discuss logistic issues with the directors and teachers, and to tell the children about the upcoming study. Information regarding the children's names, dates of birth, and sex were obtained from the school registries. Recent portrait photographs of the participating children (required for peer nomination questions) were either provided by the school or taken by a researcher during the introduction visit. Demographic data and photographs were entered into the assessment program prior to the task administration. The assessment procedure was standardized and a strict protocol was followed at all times.

On the day of the assessment, prior to the start of the computer task, a researcher gave the children instructions about the task and explained the meaning of bullying, using illustrations from the assessment instrument. Children were asked to complete a computer task about friendships and bullying and to answer questions about themselves and their classmates. They were asked to listen to the questions very carefully, and it was emphasized that they should answer questions honestly. The researcher explained that this assessment was about children at school and that many children have friends at school; however, it can also happen that some children get bullied. The concept of bullying was then introduced and some examples of behaviors that are not considered bullying were discussed. Also, some extra instructions with regard to technical issues were given. For example, children were told that researchers were available to help if needed; that they should not get up or walk around during the task; and that when they had finished the task, they should remain seated until the researcher came by. Children were tested in groups of six or less pupils at a time. After the introduction, children were seated in front of computers with a sufficient distance between them to ensure privacy. Participating children were told that their answers would be

^d Socio-demographic characteristics were available for these 861 children, including maternal education and household income. The educational level of the mother was the most elementary education for 13.9%, lower or intermediate vocational education for 48.0%, and higher vocational training or higher academic education for 38.1% of the Generation R subsample. The net monthly income of the household was below social security level for 7.8% of the subsample.

treated confidentially. Children heard via headsets a short introduction and instructions. A self-identification task was carried out to check whether the children could recognize themselves and their classmates on the pictures. The computer task was completed by each child independently. Each question was accompanied by an audio and visual description of a situation specific to the concept being investigated. For instance, to assess physical bullying, a picture depicting physical bullying was shown and described. Children were asked whether any of their classmates often behaved that way towards them. If they answered this affirmatively, children were asked to nominate the classmates who exhibited the depicted behaviors towards them. They could nominate classmates by clicking on their photographs. The photos were displayed in a random order in each assessment. The number of nominations was restricted to six for peer acceptance and rejection questions, and to ten for questions regarding bullying, victimization, and defending. The average time required for task completion was 7.9 minutes ($SD = 1.5$ minutes).

Measures

Peer acceptance and rejection

The assessment of *peer nominations* started with questions about *peer acceptance and rejection*. Children were asked to imagine that they were going to go on an exciting school trip, and to nominate the children they would like to take with them on the trip (peer acceptance) and those they would rather not take along (peer rejection). They could click on the photos of their classmates to answer the questions. The numbers of nominations children received individually from their same- and other-sex classmates with regard to “acceptance” and “rejection” were used to create measures of same- and other-sex peer acceptance and peer rejection. After the numbers of received nominations had been summed, proportions were calculated to take the differences in the number of respondents per class into account, yielding scores from 0 to 1 (see Veenstra et al., 2007 for more information on this dyadic peer nomination procedure).

Bullying and victimization

The concept of bullying was explained to the children in accordance with Olweus’s definition of bullying (Olweus, 1996): it was described as intentional, repeated, and continuous actions of peer aggression, in a context in which the victim finds it difficult to defend him- or herself. The concept was described extensively using age-appropriate language, and different forms of bullying were discussed. In addition, examples of behaviors that should not be considered bullying (teasing in a friendly and playful way; fighting between children of equal strength) were also provided.

The numbers of nominations children received individually from their same- and other-sex classmates with regard to different forms of bullying and victimization were used to create

measures of same- and other-sex bullying and victimization. We asked about four forms of bullying: (1) verbal: calling names or saying mean things to a child; (2) material: taking, hiding, or breaking the belongings of a child; (3) physical: hitting, kicking, or pushing; (4) relational: excluding or ignoring a child. The four different forms of victimization were assessed using dyadic questions, referring to questions asking by whom they were bullied. All forms of bullying correlated positively with each other, with relational bullying having the weakest correlation with all three other types of bullying. The correlations between verbal, material, and physical ranged from .52 to .69, whereas the correlations of relational bullying with the three other forms ranged from .28 to .47. We combined the different forms of bullying into a reliable bullying scale, using the nominations that children received from their classmates for these four questions ($\alpha = .78$). The victimization scale was derived from the nominations that children gave for these four questions to indicate their bullies ($\alpha = .72$). The intra-class correlation coefficients (for bullying: ICC = .78, $p < .001$; for victimization: ICC = .67, $p < .001$) and Bland-Altman plots demonstrated good test-retest reliability with a three-month interval between the assessments (Verlinden et al., 2012).

Defending

Next, the children answered a question about defending. Children were asked "By whom are you defended if you are bullied?" If children were not bullied, they were told they could nominate those who they believed would defend them in the event of bullying. We felt justified in asking also children other than pure victims to nominate their defenders in bullying situations (Huising & Veenstra, 2012), because children do not necessarily have to be victimized in order to be defended (Adler & Adler, 1995). In essence, it can be expected that successful defending prevents victimization or alleviates its consequences (Sainio et al., 2011). Again, we followed the dyadic peer nomination procedure to derive measures of same- and other-sex defending.

Analyses

We tested our hypotheses with multiple regression analyses using cross-sectional data. Because both acceptance and rejection deviated from normality, we conducted regression analyses using the Tobit model, which accounts for violations of normality of the dependent variables (Long, 1997; Smith & Brame, 2003; Tobin, 1953). The regression analyses included main effects of sex, bullying of boys and of girls, victimization reported by boys and by girls, defending of boys and of girls, and (the significant) interaction effects between sex and bullying, victimization, and defending. White-Huber standard errors that adjust for clustering of individuals within classrooms are reported. The effects for girls are equal to the main effects in Table 3, but the effects for boys are the sum of the main and interaction effects (Aiken & West, 1991). All continuous variables were standardized for the whole sample ($M = 0$, $SD = 1$).

RESULTS

Descriptive Analyses

Table 1 shows that same-sex classmates were more accepted and more defended and less rejected than other-sex classmates by both boys and girls. Furthermore, boys were more rejected than girls. Table 1 also shows that boys were more often nominated as perpetrators of bullying by both boys and girls. The proportion of nominations that, for instance, boys gave (the so-called outdegree) was .061 for being victimized by other boys and .039 for being victimized by girls. These same numbers are also listed in Table 1 in the row for bullying of boys: the number of nominations for bullying that boys received (the so-called indegree) from other boys was .061 and from girls was .039. Note that the standard deviations of the outdegrees are, as usual, larger than the standard deviations of the indegrees (Veenstra et al., 2007).

The correlations between the study variables are shown in Table 2. Defending of boys and girls, referring to the indegrees for defending, is almost not correlated ($r_s = .14$ for girls and $.15$ boys); acceptance by boys and girls ($r_s = .20$ for girls and $.25$ for boys) is weakly correlated; whereas bullying of boys and girls ($r_s = .38$ for girls and $.49$ for boys), rejection by boys and girls ($r_s = .42$ for girls and $.50$ for boys), and victimization by boys and girls ($r_s = .51$ for girls and $.53$ for boys) are moderately correlated. These findings reveal that same-sex and other-sex relations share at most a quarter of the variance. It is, thus, worthwhile to examine them separately, which we did in the following analyses.

Table 1 Means and Standard Deviation of Peer Acceptance and Rejection, Bullying, Victimization, and Defending for Boys (N=1063) and Girls (N=1072)

	Boys		Girls	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Acceptance by boys	.378	(.222)	.070	(.119)
Acceptance by girls	.073	(.114)	.364	(.236)
Rejection by boys	.138	(.159)	.226	(.187)
Rejection by girls	.269	(.211)	.093	(.134)
Bullying of boys	.061	(.072)	.039	(.048)
Bullying of girls	.078	(.076)	.040	(.049)
Victimization by boys	.061	(.095)	.079	(.121)
Victimization by girls	.039	(.083)	.040	(.064)
Defending of boys	.231	(.162)	.055	(.087)
Defending of girls	.053	(.081)	.268	(.179)

Table 2 Correlations among the Study Variables for Boys (Below the Diagonal) and Girls (Above the Diagonal)

	1	2	3	4	5	6	7	8	9	10
1. Acceptance by boys	-	.20	-.25	-.10	.00	.05	-.04	-.06	.51	.13
2. Acceptance by girls	.25	-	-.18	-.47	-.11	-.14	-.07	-.17	.17	.64
3. Rejection by boys	-.50	-.13	-	.42	.35	.29	.20	.20	-.16	-.09
4. Rejection by girls	-.22	-.28	.50	-	.28	.43	.16	.27	-.10	-.35
5. Bullying of boys	-.15	-.06	.44	.34	-	.38	.21	.15	.07	-.06
6. Bullying of girls	-.04	-.03	.31	.50	.49	-	.19	.26	.06	-.14
7. Victimization by boys	-.05	.04	.18	.16	.26	.20	-	.51	-.05	-.06
8. Victimization by girls	-.01	.03	.12	.12	.18	.21	.53	-	-.04	-.15
9. Defending of boys	.56	.16	-.30	-.13	-.04	.07	-.02	.01	-	.14
10. Defending of girls	.14	.46	-.06	-.16	.02	.01	.00	.03	.15	-

Note. $N = 2135$. All correlations larger than $|\text{.08}|$ are significant at $p < .01$.

Regression Analyses

Bullies as Potential Threats

The results of the regression analyses are presented in Table 3. If children bully girls, they are more rejected by girls ($b = .46$, $t(2134) = 10.93$, $p < .01$) than by boys ($b = .19$, $t(2134) = 4.98$, $p < .01$). Children who bully boys are more rejected by boys ($b = .36$, $t(2134) = 9.45$, $p < .01$) than by girls ($b = .12$, $t(2134) = 3.04$, $p < .01$). Thus, for same-sex and other-sex bullying, it holds that there is more rejection by those of the same sex as the victims.

Selection of Victims

The left panel of Table 3 shows that victims of male bullies are rejected by boys only ($b = .08$, $t(2134) = 2.24$, $p = .03$). Female victims of female bullies are rejected by girls only ($b = .11$, $t(2134) = 2.53$, $p = .01$). Thus, bullies seem to select victims who are rejected by the same-sex classmates of the bullies.

From the results presented in the right panel of Table 3, we see that females victimized by girls have a low level of acceptance among girls ($b = -.11$, $t(2134) = -2.59$, $p = .01$). Contrary to our expectations, males victimized by girls or boys and girls victimized by boys do not have a low level of acceptance.

Bullying and Peer Acceptance

There is, as predicted, no negative relationship between bullying of girls and acceptance. However, contrary to our expectations, children who bully boys are less accepted by boys ($b = -.10$, $t(2134) = -3.18$, $p < .01$) and by girls ($b = -.07$, $t(2134) = -2.46$, $p = .01$). This may suggest that children who bully boys lose (same-sex) peer affection.

Table 3 Multiple Regression Analyses on Peer Rejection and Peer Acceptance and their Relation to Bullying, Victimization, and Defending (N=2135)

	Peer rejection by boys		Peer rejection by girls		Peer acceptance by boys		Peer acceptance by girls	
	<i>B</i>	(<i>SE</i>)	<i>B</i>	(<i>SE</i>)	<i>B</i>	(<i>SE</i>)	<i>B</i>	(<i>SE</i>)
Sex (1=boys)	-.51	(.09) **	.68	(.08) **	1.17	(.09) **	-.80	(.08) **
Bullying of boys	.36	(.04) **	.12	(.04) **	-.10	(.03) **	-.07	(.03) *
Bullying of girls	.19	(.04) **	.46	(.04) **	-.01	(.03)	-.04	(.03)
Victimization by boys	.08	(.03) *	.03	(.03)	.00	(.02)	.03	(.02)
Victimization by girls	.03	(.04)	.11	(.04) *	-.01	(.02)	-.11	(.04) **
Defending of boys	-.41	(.04) **	-.17	(.03) **	.78	(.06) **	.12	(.02) **
Defending of girls	-.04	(.05)	-.39	(.03) **	.08	(.04) *	.64	(.03) **
Sex X Victimization by girls			-.12	(.05) *			.11	(.04) **
Sex X Defending of boys					-.27	(.06) **		
Sex X Defending of girls							.20	(.07) **
Left-censored observations	540		690		683		671	
Pseudo <i>R</i> ²	11.2%		19.5%		30.6%		30.8%	

Note. White-Huber standard errors that adjust for clustering of individuals within classrooms are reported. Pseudo *R*² values obtained from Tobit analyses are reported.

***p* < .01; **p* < .05

Defenders as Potential Protectors

Table 3 shows that defenders are more preferred (higher on peer acceptance and lower on peer rejection) by the group toward which the defending is directed. The left panel shows that boys and girls who defend boys are less rejected by boys ($b = -.41$, $t(2134) = -11.10$, $p < .01$) than by girls ($b = -.17$, $t(2134) = -4.93$, $p < .01$). Boys and girls who defend girls are only less rejected by girls ($b = -.39$, $t(2134) = -12.55$, $p < .01$).

The right panel shows that if girls defend girls, they are more accepted by girls ($b = .64$, $t(2134) = 21.26$, $p < .01$) than by boys ($b = .08$, $t(2134) = 2.14$, $p = .03$). Boys who defend boys are more accepted by boys ($b = .51$, $t(2134) = 17.46$, $p < .01$) than by girls ($b = .12$, $t(2134) = 4.70$, $p < .01$). If boys defend girls, they are by far more accepted by girls ($b = .84$, $t(2134) = 12.18$, $p < .01$) than by boys ($b = .08$, $t(2134) = 2.14$, $p = .03$). Girls who defend boys are by far more accepted by boys ($b = .78$, $t(2134) = 14.17$, $p < .01$) than by girls ($b = .12$, $t(2134) = 4.70$, $p < .01$).

In sum, these results suggest that defenders are primarily preferred by the group toward which the defending is directed. We also found that, for both boys and girls, there is a higher effect of defending on peer acceptance if it is directed toward the other sex.

DISCUSSION

This study is the first to examine the relations of bullying, victimization, and defending with peer acceptance and peer rejection among children in grades 1-2. We used a computerized task conducted among 2,135 children from 22 elementary schools to examine the associations. Same-sex and other-sex bullying, victimization, defending, acceptance, and rejection were distinguished using dyadic data. Both boys and girls were more likely to accept same-sex classmates than other-sex classmates, and boys were more often nominated than girls as perpetrators of bullying against both boys and girls.

Based on goal-framing theory, we argued that both status and affection are important goals for children, and that children who want to dominate in a group will be keenly aware of the opportunities that assist them in achieving the status goal without risking loss of affection from significant others. Our first set of hypotheses dealt with bullying as a so-called selective threat. This means that we hypothesized that bullies would only be rejected by those for whom they were a potential threat, and this bore out. Our findings demonstrated that bullies were indeed rejected by the sex who experienced their bullying. This association did not depend on the sex of the bully.

Our second set of hypotheses dealt with the bullies' choice of victims who were disregarded by significant others. We hypothesized that strategic bullies would focus on potential same-sex victims who were not preferred by the bullies' same-sex classmates. For potential other-sex victims we hypothesized that these children would focus only on victims who were rejected by the bullies' same-sex classmates. Thus, we expected that boys would bully only girls who were disliked by other boys, regardless of what girls thought about them; and the same would apply to girls who bullied boys. We found that victims of male bullies were indeed rejected by boys only, and that victims of female bullies were rejected by girls only.

Female victims bullied by girls scored low on peer acceptance by girls. We did not find the same for male victims bullied by boys. This last finding is contrary to our expectations and is also not in line with Veenstra et al. (2010), who found that male victims have a low level of acceptance among boys. In addition, bullying of boys was related to less peer acceptance by both sexes. It may thus very well be that these bullies did not choose their victims wisely. Bullies at these young ages may not always be strategic enough in selecting victims of the relevant outgroup or skilled in determining ingroup and outgroup membership. Veenstra et al. (2010) found that preadolescent boys who bullied other boys were more accepted by girls. This study did not provide evidence for that. It seems that the traits that bullies display in the early school years are not attractive to the other sex, whereas this is the case in adolescence (Volk, Camilleri, Dane, & Marini, 2012). Some children who bully may be dysregulated and bully from a reactive stance. These may be the extremely disruptive children with whom most children in the class have problems. In controlling for victimization, we believe that we were able to isolate bullies who are instrumental rather than reactive as evidence suggests reactive

children are more likely victimized by their peers, but it is possible that there was still a lack of discrimination among the bullies in our analyses and that that accounts for some of the unexpected findings.

Furthermore, we hypothesized that defenders would be accepted primarily by those for whom they were a potential defender, and this bore out. Defenders were indeed preferred by the sex to whom their prosocial behavior was directed but not by the sex to whom it was not directed. In addition, this differed for same-sex and other-sex defending. The peer acceptance of other-sex defenders was even higher than the acceptance of same-sex defenders. This was found for boys who defended girls as well as for girls who defended boys. In defending, the bystander takes a clear stand on behalf of the victim by directly stepping in, seeking help, or comforting the victim (Gini et al., 2008; Pöyhönen et al., 2010; Pöyhönen, Juvonen, & Salmivalli, 2012; Pozzoli & Gini, 2010). Such behavior is usually highly rewarded. This reward seems even to be higher when children defend the other sex, probably because they exhibit behavior that is unique and quite brave, and that in turn reinforces their likeability in the group (compare Hawkins, Pepler, & Craig, 2001; Sainio et al., 2011).

In line with earlier research (Dijkstra et al., 2007; Veenstra et al., 2010), we found that the explained variance for acceptance (about 30%) was higher than the explained variance for rejection (about 15%). It is likely that this difference is due to the fact that sex plays a larger role in the realization of interaction goals (and thus peer acceptance) than in the disturbance or threat of disturbance of goal pursuit (and thus peer rejection). However, as Dijkstra et al. (2007) pointed out, acceptance and rejection are not simply an ingroup (same-sex acceptance) and outgroup (other-sex rejection) phenomenon (see also Card, Hodges, Little, & Hawley, 2005). Thus, studies which are focused only on same-sex relations underestimate the importance of other-sex relations.

The findings of this study show that already at an early age, bullying and defending are related to ingroup and outgroup processes. Bullies were rejected by those for whom they posed a potential threat, whereas defenders were preferred by those classmates for whom they were a potential source of protection. In addition, we found that children who bullied girls already chose their victims strategically (see for research on perspective taking and goal-oriented behavior in early childhood: Harris, Johnson, Hutton, Andrews, & Cooke, 1989; Kuhn, 2000; Mason & Macrae, 2008). Strategic bullies are unlikely to change their behavior without the help of others, because bullying gives them many advantages with regard to admiration, status, and dominance (Sijtsema et al., 2009). What is needed is an anti-bullying program that changes the attitudes of all children in the class and makes clear to children that if they want the bullies to stop, they have to take joint actions. Such a program should also strengthen teachers' anti-bullying attitudes and self-efficacy in tackling bullying, because children often struggle with intervening without the support of authority figures. At the same time, children should be made aware of the importance and taught the skills of standing up for their classmates irrespective of whether they are friends with the victimized child or not, and whether

that child is a boy or a girl. A very promising program to stop bullying is the KiVa program (Kärnä et al., 2011b; Salmivalli, Kärnä, & Poskiparta, 2011), which also has a version for the early school years (Kärnä et al., 2011a).

Strengths and Limitations

Our study had a number of strengths and limitations. One of the strengths is the inclusion of boys' and girls' nominations for peer acceptance and rejection, bullying, victimization, and defending in the same-sex and other-sex nominations. In this study, young children were able to use the peer nominations method independently with the help of the animated interactive computer task. Another strong point is the large sample. We used a sample of 2,135 children, including a proportional number of boys and girls. In view of this sample size and the use of network questions, the findings can be considered robust.

Some limitations of the present study should be taken into account. First, a cross-sectional correlational design was used. Ultimately, in future studies, the relations between same-sex and other-sex peer acceptance and rejection, bullying, victimization, and defending should be investigated using a longitudinal design. For example, the relation between same-sex victimization and peer acceptance may be bi-directional. But even such a bi-directional relation would be consistent with the approach taken here. Peers who are not accepted might be even less accepted when they are bullied, because victimization is likely to lower their likeability. Being associated with victims might lower children's peer acceptance and make them more vulnerable to peer victimization (Hodges, Boivin, Vitaro, & Bukowski, 1999; Pozzoli & Gini, 2010; SunWolf & Leets, 2003).

Second, whereas Veenstra et al. (2007; 2010) used dyadic nominations from the perspectives of both victims and bullies, we only had such information from the perspective of the victim. Our measures of same-sex and other-sex victimization were consequently based on the nominations provided by a victim (the so-called outdegree) instead of the nominations received (the indegree) for victimization. The latter way of measuring victimization is potentially more reliable and valid (Cornell & Brockenbrough, 2004; Newcomb, Bukowski, & Pattee, 1993; Salmivalli, 2001), because it aggregates all the victimization nominations persons receive from others.

Third, a more complex measure of bullying that takes into account its form and its function may be able to capture how same-sex and other-sex bullying may affect peer acceptance and rejection and shed light on the unexpected finding that male victims bullied by boys did not score low on peer acceptance by boys.

Fourth, we examined same-sex and other-sex relations and their associations with acceptance and rejection by aggregating dyadic nominations. Future researchers may answer questions using network analysis (Huitsing et al., 2012) and examine triadic relationships (Ellwardt, Labianca, & Wittek, 2012), such as the following: do defenders help in all bullying situations or

do they only help when a specific bully or victim is involved; which characteristics of bullies, victims, and defenders predict the occurrence of such a triadic relationship?

In sum, the current findings provide evidence that the processes underlying bullying and defending are quite comparable in childhood and preadolescence. Already in grades 1-2 there is evidence for strategies involved in bullying and defending. We found that bullies were rejected by those for whom they posed a potential threat, and that defenders were preferred by those classmates for whom they were a potential source of protection. Bullies chose victims who were rejected by significant others, but contrary to our expectations, children who bullied boys scored low on affection. These bullies were possibly not strategic enough in selecting victims of the relevant outgroup.

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Chapter 5

Preschool attention deficit/ hyperactivity and oppositional defiant problems as antecedents of school bullying

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ABSTRACT

Importance: Bullying involvement predicts later psychopathology. However, little is known about early behavioral problems as antecedents of school bullying.

Objective: To determine the role of preschool behavioral problems in school bullying, we examine whether early-manifesting attention deficit/hyperactivity and oppositional defiant problems increase children's risk of bullying or victimization. Design, Setting and Participants: Population-based, prospective cohort. Our multi-informant approach comprised reports of parents, teachers and peers.

Exposure and main outcome measures: Problem behavior of children at age 1.5, 3 and 5 years was assessed by parents on the Child Behavior Checklist, using DSM-oriented scales of attention deficit/hyperactivity (ADHD) and oppositional defiant (ODD) problems. Bullying involvement in the first grades of elementary school was reported by teachers (n=3192, mean age 6.6 years), and by peer/self-reports using peer nominations (n=1098, mean age 7.6 years). First, we examined whether problem behavior scores at age 1.5, 3 or 5 years predicted a risk of being a bully, victim or a bully-victim in early elementary school. Second, we analyzed latent class growth models of ADHD and ODD problems throughout age 1.5-5 years, and studied the associations between the obtained latent classes and bullying involvement. Analyses were adjusted for a range of child and maternal covariates.

Results: Children with higher scores on behavioral problems at young age were more frequently involved in bullying at school-age. For instance, ADHD and ODD problem scores at age 3 years were each associated with the risks of becoming a bully or a bully-victim. To illustrate, higher scores on ADHD problems at age 3 years predicted the risk of becoming a bully-victim in early elementary school: $OR_{\text{BULLY-VICTIM}}=1.29$, 95%CI: 1.15-1.45 (teacher report), and $OR_{\text{BULLY-VICTIM}}=1.40$, 95%CI: 1.08-1.82 (child report). Consistently, the analyses of latent classes showed that children, whose behavioral problems were high or increased over time, had elevated risks of becoming a bully or a bully-victim at school.

Conclusions and relevance: Early-manifesting behavioral problems may increase children's vulnerability to subsequent bullying involvement. Parents, clinicians and teachers should consider preventive measures to reduce such risk among children with ADHD or ODD symptoms.

BACKGROUND

Bullying is defined as intentional and continuous peer aggression characterized by power imbalance between a bully and a victim¹. Bullying involvement, that is being a bully, victim or a bully-victim (i.e. both bullying and being victimized), is common in early elementary school.² The rates of bullying involvement across age 8-16 years suggest that its prevalence is high in early elementary school and it decreases at older ages.³ Experiencing bullying has detrimental effects on physical and mental health of children,⁴ leading to long-lasting health consequences.⁵⁻⁷ Well-conducted, longitudinal studies show that childhood experiences of bullying and victimization are associated with psychopathology, criminality and other problem behaviors in adolescence and adulthood.⁸⁻¹⁰ Particularly, the bully-victims tend to develop the highest levels of psychiatric problems.¹⁰ While it has been established that bullying involvement increases children's risk of psychopathology, less is known about the behavioral problems of children prior to school entry and prior to their possible involvement in bullying. Are children with specific behavioral problems at preschool age more likely to become a bully or a victim at school? And if so, at what age does such vulnerability become evident? Answers to these questions are fundamental to timely prevention efforts.

The direction of the association between psychopathology and bullying has been a topic of debate.¹¹ Evidence from both sides suggests that the association may be bidirectional.¹² Thus, early-manifesting behavioral problems may predispose children to bullying. At the same time, if a child with pre-existing behavioral problems experiences bullying or victimization, that may exacerbate these problems or may trigger new behavioral problems. In reference to a possible antecedent effect of early psychopathology, Hwang and colleagues suggest that in particular children with disruptive behavior, such as deficit/hyperactivity disorder (ADHD) or oppositional defiant disorder (ODD), could be inclined to demonstrate peer aggression.¹² However, prospective studies of young children that could examine such antecedent effect are largely lacking. Cross-sectional research in adolescents suggests that children who bully or are victimized generally experience a whole range of mental health disorders, with the greatest risks reported among bully-victims.¹³ Several studies of school-age children, mainly adolescents, reported bullying and victimization among children with ADHD¹⁴⁻¹⁹, oppositional^{17,20} and conduct problems.²¹⁻²⁶ However, as most of these earlier studies were cross-sectional and most were carried out in relatively small and often clinical samples, the temporal relation between early behavioral problems and bullying remains unclear. Thus, given that both ADHD and ODD are implicated in bullying²⁷ and that ADHD and ODD are among the most common child disorders in many western societies,²⁸⁻³¹ it is important to understand whether these behavioral problems, when existent already prior to school entry, predispose children to school bullying.

To better understand the role of preschool psychopathology as an antecedent of school bullying, researchers should: (a) use large population-based samples, (b) assess child problem behavior prospectively from an early age onwards, (c) use information obtained from different informants to avoid a problem of shared method variance, and (d) adjust for important confounders.¹² In the present study, we address these methodological challenges and aim to examine whether early-manifesting behavioral problems predict bullying involvement in elementary school. To this aim we analyzed children's scores on attention deficit/hyperactivity problems and oppositional defiant problems at ages 1.5, 3 and 5 years as predictors of bullying and victimization in the first grades of elementary school. Additionally, we examined whether any specific patterns of early-manifesting problem behavior, e.g. increasing behavioral problems throughout age 1.5 – 5 years, predict bullying involvement at school. Based on the studies reviewed above, we hypothesized that higher levels of ADHD or ODD problems at preschool age will be associated with an increased risk of bullying involvement.

METHODS

Design

Our study was embedded in the Generation R Study, a large population-based birth cohort in Rotterdam, the Netherlands. An extensive description of the cohort and various assessments that were carried out among children and parents can be found elsewhere.^{32,33} All participants provided written informed consent, and the study was approved by the Medical Ethics Committee of Erasmus Medical Centre.

Data on children's behavioral problems (i.e. minimum two assessments throughout ages 1.5, 3 and 5 years) were available for 5058 Generation R children. At the time the Generation R participants attended grades 1-2 of elementary school, teachers were asked to fill out a questionnaire that included questions about child bullying involvement at school. Teacher reports of bullying were available for 3192 children. This data collection was restricted to the area of Rotterdam and city suburbs. As a result of that, for half of the eligible children the teacher reports were not available because those children resided outside of Rotterdam and suburbs (933 of the 1866 with missing teacher data), and reports of the other half were missing due to non-responding schools/teachers. As part of a different study,³⁴ an extensive peer nomination assessment of bullying involvement was carried out in a subsample of the Generation R Study participants and their classmates attending the first grades of elementary school. From those Generation R children whose behavioral problems were assessed at least twice at age 1.5 – 5 years, the peer nominations of bullying involvement were available for 1098 children. Consequently, the association of early behavioral problems with bullying involvement was

studied in a sample of 3192 children using teacher report, and in a sample of 1098 children using peer/self-report of bullying involvement^e.

Measures

Child problem behavior

The Dutch version of the Child Behavior Checklist (CBCL1½-5)³⁵ was used to obtain parent reports of child behavioral problems at the ages 1.5, 3 and 5 years. Parents rated children's problem behavior in the preceding two months on a three-point scale ranging from "not true" to "very true or often true". Two DSM-oriented scales were used in our analyses: Attention Deficit/Hyperactivity Problems (6 items) and Oppositional Defiant Problems (6 items). The reliability and validity of the CBCL1½-5 scales are well established.³⁵⁻³⁷

Bullying involvement: teacher reports

Teachers rated children's involvement in bullying (n=3192, mean age 6.6 years) over the past three months with regard to four types of bullying (physical, verbal, relational and material). More information about the procedure of the assessment can be found elsewhere.² To assess physical victimization, teachers were asked: "Was a child victimized physically by other children, for instance by being hit, kicked, pinched, or bitten?". Verbal victimization was measured by: "Was a child victimized verbally, for instance by being teased, laughed at, or called names?". Relational victimization was assessed by: "Was a child excluded by other children?". Lastly, material victimization was studied by the question: "Were the belongings of a child hidden or broken by other children?". Bullying was measured using the same type of questions to inquire about a child's behavior as a bully. For example, to assess physical bullying teachers were asked: "Did a child physically bully other children, for instance by hitting, kicking, pinching, or biting them?". Items were rated on a four-point Likert scale with answer categories ranging from "Never or less than once per month" to "More than twice per week". Based on these ratings we categorized children into four mutually exclusive groups: "uninvolved in bullying", "bullies", "victims" and "bully-victims".² Children, whose behavior with regards to all bullying and victimization items was rated with "Never or less than once per month", were categorized as "uninvolved in bullying". Children were categorized as "victims" if teachers reported them being victimized in any of the four forms of victimization at least once a month. Similarly, children were categorized as "bullies" when a teacher reported their involvement as a bully in any form of bullying at least once a month. Children rated by teachers as both bullies and victims were categorized as "bully-victims".

^e The overlap between the samples of the teacher reports and peer/self-report of bullying involvement was n=907. To ensure the consistency of the study findings, we repeated our analyses in this overlapping group (see results section: 'Behavioral problems at ages 1.5, 3 and 5 years and bullying at school').

Peer nominations

As part of a different study, children (n=1098, mean age 7.6 years) and their classmates completed a computerized peer-nomination assessment, the PEERS Measure, during which they reported about experience of peer victimization and nominated their aggressors. A detailed description of the instrument and procedure can be found elsewhere.³⁴ Again, four questions were used to assess different forms of victimization: physical, verbal, relational and material. In this assessment the peer nomination method was used: children nominated their classmates in order to indicate by whom they were victimized. The number of nominations a child gave to others was used to calculate individual victimization scores. The nominations each child received from classmates were used to calculate individual bullying scores. Considering that on average a school class consisted of 21 children, each child's bullying score was based on the ratings of about 20 peers. Therefore, the bullying score of each child reflects the extent to which a child is perceived as a bully by his/her classmates. Higher scores represented more bullying/victimization involvement. The individual bullying and victimization scores across different forms of bullying were averaged to obtain the overall victimization and bullying scores. In order to define specific roles of children's involvement in bullying, we dichotomized the continuous bullying and victimization scores using the top 25th percentile as cut-off in the entire group of children who performed the assessment. This cut-off has previously been applied by other researchers using the peer nomination method.³⁸ The dichotomized measures were then used to categorize children into the non-overlapping groups: *"uninvolved in bullying"*, *"bullies"*, *"victims"* and *"bully-victims"*.

Covariates

Potential confounders were selected based on conceptual relevance^{2,14,39-42} and based on the alteration of the effect estimate after covariate inclusion. Analyses were adjusted for: child age, gender, national origin and daycare attendance; maternal age, parity, educational level, marital status, household income, symptoms of depression and parenting stress. Information about child's date of birth and gender was obtained from hospital registries. All other covariates were assessed using parental questionnaires. National origin of a child was defined by country of birth of the parent(s) and categorized as *Dutch*, *Other Western* or *Non-western*.⁴³ Daycare attendance, assessed at age one year, was categorized as *"not attending daycare"* and *"attending daycare"*. Birth order (i.e. parity) was used to categorize children as *"first-born"* and *"not first-born"*. The highest attained educational level of the mother (4 categories) ranged from *"low"* (<3 years of general secondary education) to *"high"* (higher academic education/PhD).⁴⁴ Marital status was dichotomized as: *"married/living together"* and *"single"*. The net monthly household *income* was categorized: *"below social security level"* (<1600 Euros), *"average"* (1600-3200 Euros) and *"above modal"* (>3200 Euros). We used the Brief Symptom Inventory, a validated instrument containing 53 self-appraisal statements⁴⁵ on psychological symptoms. Maternal symptoms of depression (6 items) were assessed when children were 3

years old. Parenting stress was assessed when children were 1.5 years old, using the Parental Stress Index⁴⁶, a questionnaire consisting of 25 items on parenting stress related to parent and child factors. In both measures, sum scores were used in the analyses.

Statistical analyses

We analyzed whether children's preschool behavioral problems are associated with the risk of bullying involvement. First, we used multinomial logistic regression analyses to examine whether the problem behavior at a specific age (1.5, 3 or 5 years) predicted the risk of being a bully, victim or a bully-victim (vs. uninvolved).

Second, we defined groups of children based on their patterns of behavioral problems over time. For this, we analyzed latent class growth models (LCGM) of behavioral problems at 1.5, 3 and 5 years, using Mplus (version 6)⁴⁷. This method distinguishes groups of children with differential patterns of problem scores, potentially unraveling emerging developmental trajectories of these children. This analysis yielded a latent variable that combines information about children's problem scores across ages. Hence, children with similar patterns of behavioral problems over time were grouped together into latent classes.

Several latent class models were examined: we started with an initial model containing one class and proceeded by increasing the number of classes until a parsimonious model with good fit indices was identified. Following the recommended criteria⁴⁸, the number of latent classes was identified based on the model fit characteristics – the smallest BIC (Bayesian Information Criteria) and a large Entropy. Besides these typical fit indices, we also considered the interpretability and size of the latent classes, model parsimoniousness and posterior probabilities of the classes. The identified classes were then analyzed as predictors of bullying involvement at school, using multinomial logistic regression models as described above.

In all regression analyses we first examined the crude effects in the unadjusted models and then the adjusted model effects, accounting for socio-demographic and psychosocial covariates. Missing data in the covariates were estimated using multiple imputation technique (chained equations). All covariates were used to estimate the missing values. The reported effect estimates are the pooled results of 30 imputed datasets. The imputed datasets were generated using STATA (Stata/SE 12.0, StataCorp LP Texas). In order to account for the clustered structure of the data (i.e. children from the same school classes were tested), we performed multinomial logistic regression analyses using clustered robust standard errors (Huber-White method of variance estimation). School class was used as cluster variable.

Non-response analysis

Among all children whose behavioral problems at age 1.5 – 5 years were assessed at least twice, we compared those with (n=3192) and those without (n=1866) the teacher reports of bullying involvement. The groups were compared on a number of socio-demographic characteristics. Children without teacher report of bullying involvement did not differ from the study-sample with regard to: maternal age, maternal depression symptoms or parenting stress. There were some differences between the included and excluded in analyses children with regard to the scores on the DSM-oriented scales of behavioral problems. Children with missing teacher data had slightly higher ODD problem scores at age 5 years (mean score 2.58 vs. 2.33, p-value<0.001). Among those with missing teacher data on bullying involvement there were more children from families with a low household income (10.2% vs. 12.2%, p-value=0.04) and of non-Dutch national origin (and 20.3% vs. 25.6%, p-value<0.001) than among those included in the analyses.

RESULTS

Study-sample characteristics

The socio-demographic and psychosocial characteristics of the children in the two study samples are presented in Table 1. The characteristics of the samples were similar. In teacher data, 50.7% of the sample were boys, children were on average 6.6 years old (SD= 14.1 months) and largely of Dutch national origin (65.3%). Based on teachers' ratings, 69.9% of children were categorized as uninvolved in bullying, 14.1% as bullies, 4.2% as victims and 11.8% as bully-victims. Proportions of bullying involvement in the peer/self-reported sample were: 70.1% uninvolved in bullying, 10.8% bullies, 13.1% victims and 6% bully-victims.

Behavioral problems at ages 1.5, 3 and 5 years and bullying at school

The behavioral problem scores on attention deficit/hyperactivity and oppositional defiant problem scales at ages 1.5, 3 and 5 years were analyzed as predictors of bullying involvement in elementary school. The results in Tables 2 and 3 show which early-manifesting behavioral problems predict children's risk of becoming a bully, victim or bully-victim. The results of the unadjusted analyses are presented in supplementary Tables 1-2. For purpose of brevity, we further describe only the results of the adjusted analyses.

At age 1.5 years, behavioral problems were not associated with teacher- or peer/self-reported bullying involvement (Tables 2 and 3), except for the higher scores on oppositional defiant problems that predicted a slightly higher risk of becoming a *bully* (Table 3, peer/self-report: OR=1.24, 95%CI: 1.00-1.52).

At age 3 years (Tables 2 and 3), higher scores on attention deficit/hyperactivity problems predicted the risks of becoming: a *bully* (teacher report: OR=1.21, 95%CI: 1.08-1.35); a *bully-victim* (teacher report: OR=1.29, 95%CI: 1.15-1.28, peer/self-report: OR=1.40, 95%CI: 1.08-1.82), and a *victim* (peer/self-report: OR=1.20, 95%CI: 1.00-1.44). Higher scores on oppositional defiant scales predicted the risk of becoming: a *bully* (teacher report: OR=1.18, 95%CI: 1.06-1.32); and a *bully-victim* (teacher report: OR=1.15, 95%CI: 1.02-1.28, peer/self-report: OR=1.36, 95%CI: 1.03-1.78).

At age 5 years (Tables 2 and 3), higher scores on attention deficit/hyperactivity problems predicted the risk of becoming: a *bully* (e.g. teacher data: OR=1.35, 95%CI: 1.19-1.49, peer/self-

Table 1. Child and maternal characteristics

	Bullying involvement reports			
	Teacher report (N=3192)		Peer/Self-report (N=1098)	
	N	% ^a	N	% ^a
Child characteristics				
Age (mean in years, SD)	2858	6.56 (1.18)	1098	7.62 (0.74)
Gender (% boys)	3192	50.7	1098	48.7
National origin				
Dutch	2081	65.3	745	67.9
Other Western	289	9.1	125	11.4
Non-western	815	25.6	227	20.7
Bullying involvement ^b				
Uninvolved	2233	69.9	770	70.1
Bully	450	14.1	119	10.8
Victim	133	4.2	144	13.1
Bully-victim	376	11.8	65	6.0
Behavioral problems scores at age 1.5 years ^c (mean score, SD):				
Attention deficit/ hyperactivity problems score	2900	3.86 (2.45)	997	3.77 (2.44)
Oppositional defiant problems score	2883	3.15 (2.15)	992	3.10 (2.13)
Behavioral problems scores at age 3 years ^c (mean score, SD):				
Attention deficit/ hyperactivity problems score	2910	2.94 (2.28)	1007	2.75 (2.24)
Oppositional defiant problems score	2902	2.84 (2.09)	1000	2.87 (2.14)
Behavioral problems scores at age 5 years ^c (mean score, SD):				
Attention deficit/ hyperactivity problems score	3002	2.84 (2.44)	1049	2.65 (2.32)
Oppositional defiant problems score	2994	2.33 (2.17)	1047	2.31 (2.16)
Day-care attendance (% not attending)	1944	21.6	706	18.7

Table 1. Child and maternal characteristics (*continued*)

	Bullying involvement reports			
	Teacher report (N=3192)		Peer/Self-report (N=1098)	
	N	% ^a	N	% ^a
Maternal characteristics				
Age at intake (mean in years, SD in months)	3192	31.57 (4.64)	1098	32.25 (4.66)
Educational level				
High	923	30.3	345	32.9
High intermediate	726	23.8	276	26.3
Low intermediate	904	29.7	306	29.2
Low	494	16.2	121	11.6
Monthly household income				
>3200 euros	1570	55.4	554	55.3
1600-3200 euros	916	32.4	340	34.0
<1600 euros	345	12.2	107	10.7
Marital status (% single)	2831	8.2	1046	8.8
Depression symptoms ^d (mean score, SD)	2895	0.12 (0.31)	999	0.13 (0.30)
Parenting stress ^e (mean score, SD)	2916	0.31 (0.30)	1000	0.31 (0.29)
Parity (% first-born)	1944	55.4	1098	55.1

^a Unless indicated differently.

^b Bullying involvement was measured using a teacher questionnaire and a peer nomination measure.

^c Assessed with the CBCL 1½-5, the Dutch version of the Child Behavior Checklist.

^d Measured with the Brief Symptom Inventory.

^e Parenting stress was measured with the Parental Stress Index.

report: OR=1.35, 95%CI:1.11-1.64); *a bully-victim* (teacher report: OR=1.47, 95%CI: 1.31-1.65, peer/self-report: OR=1.77, 95%CI:1.32-2.37); and *a victim* (teacher report: OR=1.23, 95%CI: 1.02-1.48). Higher oppositional defiant problems scores predicted the risk of becoming a *bully* and a *bully-victim* in both teacher- and peer/self-reports (Tables 2 and 3).

Analyses in the sample of 907 children, for whom both the teacher and child reports of bullying involvement were available, yielded same results for the child-reported data. The effect estimates in the teacher data changed only slightly, although some associations were not significant anymore due to smaller numbers (data not presented).

Patterns of preschool problem behavior and bullying at school

Latent classes

In pursuit of capturing the effects of changes in problem behavior throughout ages 1.5 – 5 years on bullying involvement at school, we performed LCGM using the attention deficit/hy-

Table 2. Behavioral problems at young age and teacher report of bullying involvement

	Teacher report of bullying involvement at age 7 years (n=3192)					
	Bully		Victim		Bully-victim	
	OR	(95%CI) p-value	OR	(95%CI) p-value	OR	(95%CI) p-value
Behavioral problems scores at age 1.5 years						
Attention deficit/hyperactivity problems score	1.09	(0.97-1.23) 0.16	0.88	(0.72-1.08) 0.21	1.07	(0.95-1.20) 0.27
Oppositional defiant problems score	1.03	(0.91-1.13) 0.81	0.85	(0.69-1.04) 0.12	0.99	(0.87-1.12) 0.86
Behavioral problems scores at age 3 years						
Attention deficit/hyperactivity problems score	1.21	(1.08-1.35) 0.001	1.12	(0.92-1.37) 0.26	1.29	(1.15-1.45) <0.001
Oppositional defiant problems score	1.18	(1.06-1.32) 0.003	1.05	(0.86-1.28) 0.65	1.15	(1.02-1.28) 0.02
Behavioral problems scores at age 5 years						
Attention deficit/hyperactivity problems score	1.33	(1.19-1.49) <0.001	1.23	(1.02-1.48) 0.03	1.47	(1.31-1.65) <0.001
Oppositional defiant problems score	1.30	(1.17-1.46) <0.001	1.16	(0.96-1.39) 0.13	1.36	(1.22-1.51) <0.001

Continuous variables were z-standardized. Higher scores on the CBCL scales denote more behavioral problems.

Analyses adjusted for child age, sex, national origin and day-care attendance, maternal age, parity, maternal educational level, monthly household income, marital status, maternal depression symptoms, parenting stress.

Reference group 'uninvolved'.

'Uninvolved' n= 2233, 'bully' n=450, 'victim' n=133, 'bully-victim' n=376.

peractivity and oppositional defiant problem scores. We examined latent class growth models using the repeatedly assessed behavior problems in the sample of children for whom the teacher report of bullying was available as this provided us with statistical power for further analyses. Five models were examined (supplementary Table 3). An addition of a class improved the fit of each subsequent model. The models which best described the patterns of problem behavior across ages 1.5 – 5 years distinguished 4 latent classes of ADHD and 4 classes of ODD problems. The models with this number of classes were selected because in the 5 class models two of the classes followed the same pattern over time and differed from one another only in the severity of behavioral problems scores. The models with 4 classes of ADHD and 4 classes of ODD problems were preferred because these models grouped children with clearly distinct patterns of problem behavior. Also, the posterior probabilities (i.e. the probabilities of belonging to the assigned class) were higher for the models with the selected number of classes and were well above the recommended 0.7 value.

Table 3. Behavioral problems at young age and peer/self-report of bullying involvement

	Peer/Self-report of bullying involvement at age 8 years (n=1098)								
	Bully			Victim			Bully-victim		
	OR	(95%CI)	p-value	OR	(95%CI)	p-value	OR	(95%CI)	p-value
Behavioral problems scores at age 1.5 years									
Attention deficit/hyperactivity problems score	1.14	(0.92-1.42)	0.22	1.16	(0.93-1.44)	0.19	1.21	(0.85-1.72)	0.29
Oppositional defiant problems score	1.24	(1.00-1.52)	0.05	1.09	(0.89-1.33)	0.42	1.00	(0.71-1.39)	0.96
Behavioral problems scores at age 3 years									
Attention deficit/hyperactivity problems score	1.03	(0.83-1.27)	0.82	1.20	(1.00-1.44)	0.05	1.40	(1.08-1.82)	0.01
Oppositional defiant problems score	1.10	(0.90-1.36)	0.35	1.09	(0.88-1.34)	0.44	1.36	(1.03-1.78)	0.03
Behavioral problems scores at age 5 years									
Attention deficit/hyperactivity problems score	1.35	(1.11-1.64)	0.002	1.18	(0.96-1.45)	0.12	1.77	(1.32-2.37)	<0.001
Oppositional defiant problems score	1.32	(1.06-1.64)	0.01	1.12	(0.92-1.37)	0.27	1.74	(1.36-2.22)	<0.001

Continuous variables were z-standardized. Higher scores on the CBCL scales denote more behavioral problems.

Bullying was reported by multiple peers, victimization was self-reported. The category 'bully-victim' is therefore based on both the peer report of bullying and child self-report of victimization.

Analyses adjusted for child age, sex, national origin and day-care attendance, maternal age, parity, maternal educational level, monthly household income, marital status, maternal depression symptoms, parenting stress.

Reference group 'uninvolved'.

'Uninvolved' n=770, 'bully' n= 119, 'victim' n=144, 'bully-victim' n=65.

The identified latent classes of attention deficit/hyperactivity problems were: a *low-decreasing class* (comprised children with rather low and slightly decreasing ADHD problem scores across three ages, n=1966), a *moderate-increasing class* (compared to the low-decreasing class, this class grouped children who scored higher on the ADHD problems at 1.5 and 3 years and whose scores increased further at age 5 years, n=522), a *moderate-decreasing class* (combined children, whose scores were fairly high at 1.5 years but decreased at 3 years and at 5 years, n=545), and a *high-increasing class* (grouped together children with the highest ADHD scores at ages 1.5 and 3 years, and whose scores further increased at age 5 years, n=159). Figure 1 illustrates the latent classes of behavioral problems plotted against the mean scores of attention deficit/hyperactivity problems throughout ages 1.5 – 5 years. The average score of children in the high-increasing class at age 5 years was 8.27, which characterizes these children's scores as being within the borderline clinical range, following the norms for the Dutch population of this age group.⁴⁹

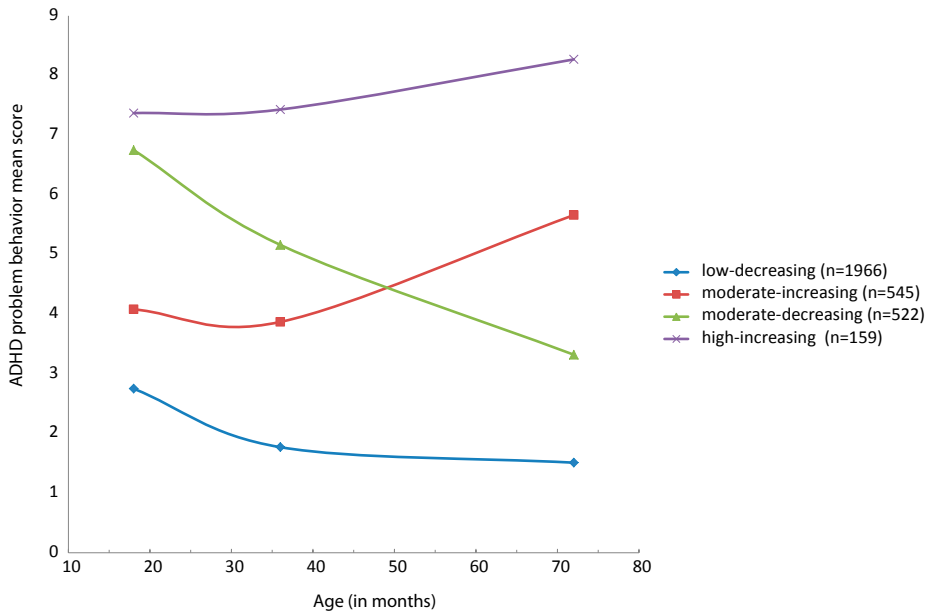


Figure 1. Latent classes of ADHD problem behavior

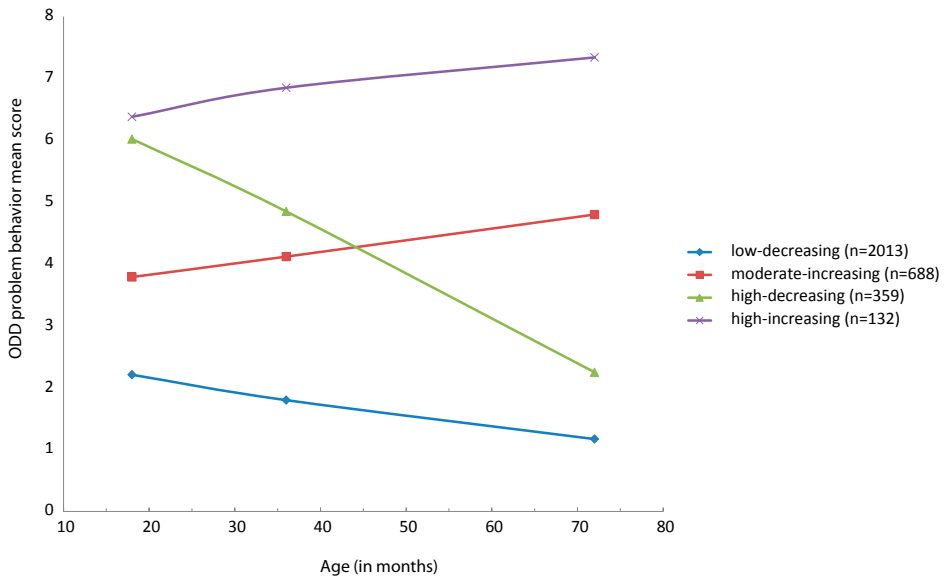


Figure 2. Latent classes of ODD problem behavior

The four latent classes of oppositional defiant problems are illustrated in Figure 2. Children with the lowest ODD scores that decreased over time, were grouped into the *low-decreasing class*, which was also the largest of the four classes (n=2013). The second largest group was labelled the *moderate-increasing class* (n=688). Compared to children in the low-decreasing class, these children were characterized by somewhat higher scores at ages 1.5 and 3 years and a slight increase in their scores at age 5 years. The *high-decreasing class* (n=359) comprised children with the highest ODD problem scores at age 1.5 years whose scores decreased substantially at ages 3 and 5 years. The *high-increasing class* (n=132) was characterized by high scores that increased over time. The mean score in the high-increasing group at age 5 years was 7.34, which characterizes these children's scores as being within the borderline clinical range, according to the norms for the Dutch population of this age group.⁴⁹

Latent classes of problem behavior and bullying involvement

In our final analysis step, we examined how the identified latent classes of ADHD and ODD problems were associated with children's bullying involvement at school. For this, a set of multinomial logistic regression models was analyzed. To be concise, we further describe only

Table 4. Latent classes of child problem behavior and teacher report of bullying involvement

Latent classes of problem behavior	Teacher report of bullying involvement at age 7 years (n=3192)								
	Bully			Victim			Bully-victim		
	OR	(95%CI)	p-value	OR	(95%CI)	p-value	OR	(95%CI)	p-value
ADHD problems:									
Low-decreasing	1	-	-	1	-	-	1	-	-
Moderate-increasing	1.53	(1.15-2.03)	0.004	1.29	(0.79-2.10)	0.32	2.12	(1.59-2.82)	<0.001
Moderate-decreasing	1.25	(0.93-1.67)	0.13	0.75	(0.44-1.28)	0.29	1.40	(1.02-1.91)	0.04
High-increasing	2.23	(1.39-3.56)	0.001	1.81	(0.85-3.86)	0.13	2.97	(1.90-4.64)	<0.001
ODD problems:									
Low-decreasing	1	-	-	1	-	-	1	-	-
Moderate-increasing	1.51	(1.17-1.94)	0.002	0.93	(0.58-1.49)	0.76	1.62	(1.24-2.10)	<0.001
High-decreasing	1.00	(0.71-1.40)	0.99	0.70	(0.37-1.32)	0.28	0.98	(0.66-1.47)	0.93
High-increasing	2.44	(1.46-4.06)	0.001	1.97	(0.89-4.37)	0.10	2.32	(1.40-3.84)	0.001

Continuous variables were z-standardized. Higher scores on the CBCL scales denote more behavioral problems.

Analyses adjusted for child age, sex, national origin and day-care attendance, maternal age, parity, maternal educational level, monthly household income, marital status, maternal depression symptoms, parenting stress.

Reference group 'uninvolved'.

'Uninvolved' n= 2233, 'bully' n=450, 'victim' n=133, 'bully-victim' n=376.

the adjusted results. The results of the unadjusted analyses are presented in the supplementary Table 4.

As shown in Table 4, the latent classes of ADHD problems (reference group: low-decreasing problems) predicted children's risks of becoming a *bully* and a *bully-victim*. Particularly, the high-increasing ADHD problems predicted high risks, especially in the bully-victims group (e.g. $OR_{\text{BULLY}}=2.23$, 95%CI: 1.39-3.56 and $OR_{\text{BULLY-VICTIM}}=2.97$, 95%CI: 1.90-4.64). In contrast, the decrease in behavioral problems throughout age 1.5 – 5 years was associated with the lowest effect estimates. The ADHD class membership did not predict the risk of becoming a victim.

The latent classes of ODD problems that are characterized by increasing over time problems predicted the risk of becoming a *bully* and a *bully-victim* (Table 4). Again, the high-increasing class membership was associated with the most pronounced risks (e.g. $OR_{\text{BULLY}}=2.44$, 95%CI: 1.46-4.06 and $OR_{\text{BULLY-VICTIM}}=2.32$, 95%CI: 1.40-3.84). The ODD class membership was not associated with an increased risk of becoming a victim.

DISCUSSION

Main findings

Attention deficit/hyperactivity and oppositional defiant problems at preschool age predicted children's bullying involvement in the first grades of elementary school, suggesting that early-age ADHD and ODD problems are possible *antecedents* of school bullying. These behavioral problems were associated with the risks of becoming a *bully* or a *bully-victim* and, to a lesser extent, with the risk of becoming a (pure) victim. Importantly, our results showed that children with higher and increasing levels of behavioral problems at preschool age are at substantially higher risk of becoming a bully or a bully-victim than children with lower or decreasing levels of problems throughout preschool age.

By unfolding the temporal antecedence of early ADHD and ODD problems in relation to subsequent school bullying, we add to former studies that examined primarily the concurrent social problems of (pre)adolescents with ADHD^{14,15,18,50-52} or ODD/CD^{17,19,21,50,51}. Our findings clearly point out that ADHD or ODD behavioral problems may increase a risk of becoming a bully or a bully-victim. Earlier, smaller cross-sectional studies also reported an association between bullying and victimization and disruptive behavior symptoms of ODD and CD adolescents²¹, between bullying and ODD¹⁷ and ADHD^{15,52}, between victimization and ADHD symptoms^{17,19,52}, as well as between ADHD symptoms and social problems with peers^{51,53,54}. In our study, ADHD and ODD behavioral problems were associated with fewer risks of becoming a (pure) victim as compared to the risks observed in bullies and bully-victims. This was consistent across teacher

and child reports, which largely rules out the reporter bias as a possible explanation of this finding. It is important to point out that, because of the behavioral characteristics of children with ADHD or ODD (e.g. their elevated aggression levels and impulsivity) these children may be far more likely to become bullies or bully-victims rather than pure victims. These children's overt aggression towards their peers may outgrow to bullying; and at the same time, their disruptive behavior can cause irritation and rejection by peers⁵⁵, thereby predisposing them to victimization. Furthermore, bullies, victims and bully-victims differ in type and extent of aggressive behavior that they display: the bully-victims demonstrate the highest levels of both proactive and reactive aggression whereas victims demonstrate the lowest levels of any aggressive behavior.^{26,56} Thus, a child with high levels of aggressive and disruptive behavior, as is often the case in children with ADHD or ODD problems, is less likely to become a pure (non-aggressive) victim. The difference in our findings between the victims and bully-victims highlights the importance of differentiating between these bullying involvement roles when studying children's vulnerability to school bullying. Possibly, in the studies in which victims and bully-victims were not distinguished, e.g.^{15,17,52,57} the reported risk of victimization may partly reflect the risk of being a bully-victim. Finally, internalizing problems, rather than externalizing problems, are more predictive of becoming a (pure) victim.⁵⁸ Considering that our study focused on the externalizing scales of problem behavior, we might have been less likely to detect the risk of pure victimization.

The effects we observed in the group of bully-victims were rather pronounced and this is consistent with the previous studies showing that the bully-victims are the most troubled group of children,²⁶ who are likely to show the greatest levels of concurrent psychopathology.^{21,24,27} Finally, showing that children with high and increasing levels of behavioral problems had increased risks of becoming a bully or a bully-victim, is consistent with research suggesting that mainly the *persistent* ADHD or conduct problems are associated with more pronounced effects on children's social functioning.⁵³ Importantly, once children with these behavioral problems become involved in school bullying, they are likely to develop a negative socio-metric status (i.e. it becomes normative among their peers to reject and dislike them).⁵⁵ Hoza suggests that, because of this, the later improvements in behavior of children with ADHD may not suffice to resolve the peer problems as then it may be also necessary to change the perception of the peers towards the children with ADHD. Therefore, it may be more beneficial to intervene and manage the behavioral problems of these children prior to them developing school social problems.

Mechanisms explaining the association

Fewer friends, peer rejection and school maladjustment^{51,53} of children with ADHD can be attributed to their poor social skills and low self-control.⁵² Children with ADHD problems tend to demonstrate inattention, impulsivity, low ability to cooperate, low frustration tolerance,

and temper tantrums,⁵⁹ which makes it hard for their peers to interact with them. In a highly structured setting such as school, children with ADHD problems may have difficulties with adapting the socially accepted behavior and following the rules. Social-cognitive characteristics (e.g. impaired executive function⁶⁰, low self-control^{52,57} and social problem-solving⁶¹) of children with ADHD or disruptive behavior, may be part of the mechanism explaining their bullying involvement. Inability to inhibit impulsive behavior or to solve a conflict in a socially acceptable manner is likely to influence their relationships with peers and teachers. Finally, children with ODD problems typically behave hostile and refuse to comply with rules,^{62,63} which is likely to affect their interactions with peers. In school setting, these children often tend to display non-normative behavior or disobey classroom rules, which may underpin their involvement in school bullying.

Due to high comorbidity of ADHD and ODD conditions⁵⁹ it may be difficult to disentangle their individual effects on children's bullying involvement. There is some evidence that child hyperactivity problems contribute to peer problems also once the oppositional behavior is accounted for.^{17,51,55} Other research shows that oppositional behavior of children may mediate the relationship between ADHD and bullying.¹⁹ Another recent study among adolescents reported that ODD problems were a stronger predictor of bullying involvement than ADHD symptoms.⁵⁰ The exact mechanism remains unclear. In our additional analyses (data not presented), the mutual adjustment of the ADHD and ODD problems clearly attenuated the effects of both behavioral problems on bullying, however most of the effects of ADHD problems remained, although some were not statistically significant any more. Nevertheless, this needs to be examined carefully in future studies, as this association may be different at older age⁵⁰ and among children who remain involved in bullying for prolonged time.

Two other methodological considerations need to be discussed. First, in contrast to the findings at age 3 and 5 years, the behavioral problems at age 1.5 years were not associated with bullying involvement. This may suggest that the association at age 1.5 years was mostly confounded, as the crude risks of becoming a bully or a bully-victim were strongly attenuated and became statistically not significant in the adjusted analyses (with the exception of the risk of becoming a bully in the child-reported data). Also, it may indicate that possible difficulties with reliably ascertaining the behavioral symptoms at very young age complicate prospective studies of ADHD and ODD problems. This highlights the importance of using repeated assessments of behavior. Second, the identified latent classes of the ADHD and ODD problems were rather similar. This may suggest that both types of behavioral problems have similar developmental trajectories. Also, this may partly reflect the phenotypic similarities or a co-occurrence of these behavioral problems at young age. In our sample, 51 children were assigned to the trajectories with the highest levels of both ADHD and ODD problems. While this overlap was not substantial, there was a moderate correlation between the ADHD and

ODD scores at the three assessment points: 1.5 years ($r=.59$), 3 years ($r=.57$) and 5 years ($r=.60$). Importantly, ADHD or ODD problems and the bullying problems may be a manifestation of the same underlying cause (e.g. a neurocognitive process, such as differences in prefrontal cortical development or a failure of the anterior cingulate cortex). It may be that the ADHD or ODD problems manifest earlier than bullying problems because the latter is a group-specific process and is more likely to manifest in stable peer groups and in structured contexts.

Limitations

Along with several strengths, such as the large population-based sample, prospective repeated measures of behavior and the use of multiple informants, our study has some limitations. First, there is a possibility of reverse causality as involvement in school bullying was assessed at a single time point. Even though there is no *school* bullying prior to school entry, children may still experience social problems with peers prior to school entry in other social contexts (e.g. kindergarten). Nevertheless, the reverse association between the behavioral problems and school bullying seems less likely in reference to the observed effect of behavioral problems at age 3 years. A similar finding at age 1.5 years (child-reported data) is also an indication of the antecedent effect. Second, while we adjusted our analyses for a range of child and maternal covariates, there may still be some residual confounding. For instance, inaccurate interpretation of social cues or hostile perception of peers' behavior by children with ADHD or ODD could trigger bullying behavior.⁵⁵ This can be addressed in future studies.

Implications

Our findings have the following implications. First, the identification of individual vulnerability to bullying involvement is possible as early as age 3 years. This highlights the importance of parental observation of child behavior in relation to later outcomes of the child. Second, given that the decreasing problems posed fewer risks for bullying involvement, early interventions directed at parents and their children⁶⁴⁻⁶⁷ may be helpful in preventing later bullying involvement. There is evidence for effectiveness of such programs in decreasing child oppositionality, hyperactivity and inattention.^{64,68,69} Improving children's social and problem-solving skills and their behavioral control⁷⁰ prior to school entry could help prevent their bullying involvement and other accumulating problems (e.g. peer rejection, learning or conduct problems^{71,72}). Enhancing social skills can help not only to decrease bullying⁷³ but may help these children establish more close friendships, which serves as a protective factor against bullying victimization.⁷⁴⁻⁷⁶ Third, at school entry, parents and teachers of children with the pre-existing behavioral problems need to be aware of the potential peer difficulties these children may have due to their behavioral problems. Also, targeting the group processes directly and ensuring positive response from the peers (i.e. overcoming the negative reputation of these children) is crucial in order to effectively resolve peer problems.⁵⁵ Importantly, teachers may require additional skills to effectively manage⁷⁷ the behavior and the educational process of

children with ADHD or ODD. Finally, clinicians and school staff can undertake actions to prevent bullying involvement among vulnerable children through their work with parents and affected children.^{78,79} To conclude, ADHD and ODD behavioral problems at young age may predispose children to bullying involvement in early elementary school. Our findings suggest the importance of managing these behavioral problems prior to school entry.

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SUPPLEMENTARY MATERIAL

Supplementary Table 1. Behavioral problems and teacher report of bullying involvement (unadjusted analyses)

	Teacher report of bullying involvement at age 7 years (n=3192)					
	Bully		Victim		Bully-victim	
	OR	(95%CI) p-value	OR	(95%CI) p-value	OR	(95%CI) p-value
Behavioral problems scores at age 1.5 years						
Attention deficit/hyperactivity problems score	1.13	(1.02-1.25) 0.02	0.95	(0.78-1.16) 0.64	1.18	(1.05-1.31) 0.004
Oppositional defiant problems score	1.04	(0.94-1.15) 0.45	0.90	(0.73-1.10) 0.31	1.06	(0.94-1.20) 0.31
Behavioral problems scores at age 3 years						
Attention deficit/hyperactivity problems score	1.25	(1.13-1.39) <0.001	1.20	(0.99-1.44) 0.06	1.41	(1.27-1.56) <0.001
Oppositional defiant problems score	1.18	(1.06-1.31) 0.002	1.06	(0.87-1.28) 0.57	1.18	(1.06-1.32) 0.003
Behavioral problems scores at age 5 years						
Attention deficit/hyperactivity problems score	1.37	(1.24-1.52) <0.001	1.31	(1.11-1.55) 0.002	1.60	(1.44-1.78) <0.001
Oppositional defiant problems score	1.31	(1.18-1.46) <0.001	1.19	(1.00-1.41) 0.06	1.41	(1.28-1.57) <0.001

Continuous variables are z-standardized. Higher scores on the CBCL scales denote more behavioral problems.

Reference group 'uninvolved'.

'Uninvolved' n= 2233, 'bully' n=450, 'victim' n=133, 'bully-victim' n=376.

Supplementary Table 2. Behavioral problems and peer/self-report of bullying involvement (unadjusted analyses)

	Peer/Self-report of bullying involvement at age 8 years (n=1098)					
	Bully		Victim		Bully-victim	
	OR	(95%CI) p-value	OR	(95%CI) p-value	OR	(95%CI) p-value
Behavioral problems scores at age 1.5 years						
Attention deficit/hyperactivity problems score	1.23	(1.01-1.49) 0.04	1.06	(0.87-1.29) 0.58	1.24	(0.91-1.67) 0.17
Oppositional defiant problems score	1.29	(1.07-1.55) 0.008	1.00	(0.83-1.21) 0.99	1.00	(0.74-1.34) 0.98
Behavioral problems scores at age 3 years						
Attention deficit/hyperactivity problems score	1.17	(0.97-1.41) 0.11	1.11	(0.94-1.32) 0.22	1.44	(1.16-1.79) 0.001
Oppositional defiant problems score	1.14	(0.94-1.39) 0.19	1.02	(0.83-1.25) 0.85	1.25	(0.98-1.61) 0.08
Behavioral problems scores at age 5 years						
Attention deficit/hyperactivity problems score	1.46	(1.23-1.73) <0.001	1.10	(0.91-1.34) 0.32	1.75	(1.36-2.24) <0.001
Oppositional defiant problems score	1.37	(1.12-1.68) 0.002	1.06	(0.88-1.29) 0.52	1.63	(1.30-2.04) <0.001

Continuous variables were z-standardized. Higher scores on the CBCL scales denote more behavioral problems.

Bullying was reported by multiple peers, victimization was self-reported. The category 'bully-victim' is therefore based on both the peer report of bullying and child self-report of victimization.

'Uninvolved': N=1098, 'uninvolved' n=770, 'bully' n=119, 'victim' n=144, 'bully-victim' n=65.

Supplementary Table 3. Model fit indices (N=3192)

Number of classes	BIC ^a	Entropy
ADHD		
1	40494	-
2	38887	0.816
3	38560	0.756
4	38408	0.786
5	38337	0.771
ODD		
1	38306	-
2	36716	0.745
3	36433	0.768
4	36231	0.753
5	36091	0.762

^aBIC: Bayesian information criterion.

Supplementary Table 4. Latent classes of child problem behavior and teacher report of bullying involvement (unadjusted analyses)

Latent classes of problem behavior	Teacher report of bullying involvement at age 7 years (n=3192)								
	Bully			Victim			Bully-victim		
	OR	(95%CI)	p-value	OR	(95%CI)	p-value	OR	(95%CI)	p-value
ADHD problems:									
Low-decreasing	1	-	-	1	-	-	1	-	-
Moderate-increasing	1.65	(1.24-2.18)	<0.001	1.52	(0.95-2.44)	0.08	2.49	(1.88-3.30)	<0.001
Moderate-decreasing	1.34	(1.02-1.76)	0.04	0.89	(0.52-1.51)	0.66	1.64	(1.21-2.23)	0.001
High-increasing	2.49	(1.61-3.85)	<0.001	2.35	(1.17-4.72)	0.02	3.97	(2.63-6.00)	<0.001
ODD problems:									
Low-decreasing	1	-	-	1	-	-	1	-	-
Moderate-increasing	1.48	(1.16-1.90)	0.002	0.95	(0.60-1.51)	0.82	1.67	(1.29-2.16)	<0.001
High-decreasing	1.02	(0.74-1.43)	0.89	0.78	(0.41-1.45)	0.43	1.09	(0.74-1.61)	0.66
High-increasing	2.42	(1.49-3.91)	<0.001	2.22	(1.07-4.63)	0.03	2.71	(1.67-4.41)	<0.001

Continuous variables were z-standardized. Higher scores on the CBCL scales denote more behavioral problems.

Reference group 'uninvolved': N=3192, 'uninvolved' n= 2233, 'bully' n=450, 'victim' n=133, 'bully-victim' n=376.

Chapter 6

Executive functioning and non-verbal intelligence as predictors of bullying in early elementary school

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ABSTRACT

Executive function and intelligence are negatively associated with aggression, yet the role of executive function has rarely been examined in the context of school bullying. We studied whether different domains of executive function and non-verbal intelligence are associated with bullying involvement in early elementary school. The association was examined in a population-based sample of 1377 children. At age 4 years we assessed problems in inhibition, shifting, emotional control, working memory and planning/organization, using a validated parental questionnaire (the BRIEF-P). Additionally, we determined child non-verbal IQ at age 6 years. Bullying involvement as a bully, victim or a bully-victim in grades 1-2 of elementary school (mean age 7.7 years) was measured using a peer-nomination procedure. Individual bullying scores were based on the ratings by multiple peers (on average 20 classmates). Analyses were adjusted for various child and maternal socio-demographic and psychosocial covariates. Child score for inhibition problems was associated with the risk of being a bully (*OR* per *SD*=1.35, *95%CI*: 1.09-1.66), victim (*OR* per *SD*=1.21, *95%CI*: 1.00-1.45) and a bully-victim (*OR* per *SD*=1.55, *95%CI*: 1.10-2.17). Children with higher non-verbal IQ were less likely to be victims (*OR*=0.99, *95%CI*: 0.98-1.00) and bully-victims (*OR*=0.95, *95%CI*: 0.93-0.98, respectively). In conclusion, our study showed that peer interactions may be to some extent influenced by children's executive function and non-verbal intelligence. Future studies should examine whether training executive function skills can reduce bullying involvement and improve the quality of peer relationships.

BULLYING INVOLVEMENT

Bullying, which is typically defined as intentional and continuous peer aggression involving power imbalance between the victim and aggressor (Olweus, 1993), is already common at the start of elementary school. About one-third of young elementary school children experience bullying either as a bully, victim or a bully-victim (Jansen et al., 2012). School bullying negatively affects health and development of both bullies and victims. Studies show that bullying involvement is associated with various short- and long-term consequences such as psychological distress, internalizing and externalizing problems (Arseneault et al., 2006), anxiety and depression (Arseneault, Bowes, & Shakoor, 2010), borderline personality and psychotic symptoms (Schreier et al., 2009; Wolke, Schreier, Zanarini, & Winsper, 2012), self-harm (Fisher et al., 2012) and suicidal ideation (Winsper, Lereya, Zanarini, & Wolke, 2012).

Several bullying involvement roles are typically defined: bully, victim, bully-victim, reinforcer, assistant, defender and outsider (Salmivalli, Lagerspetz, Björkqvist, Österman, & Kaukiainen, 1996). The roles of a bully, victim and a bully-victim are the most salient; these children are directly involved in bullying and are at higher risk of negative health outcomes. Victims are typically described as submissive, insecure children (Salmivalli & Peets, 2009), who are characterized by increased symptoms of anxiety, depression, low self-esteem and poor social skills (Arseneault et al., 2010). Bullies and bully-victims can be best described in terms of the concepts of proactive and reactive aggression (Dodge & Coie, 1987). Bullies are mostly proactively aggressive children (Camodeca & Goossens, 2005; Salmivalli & Nieminen, 2002), who favor the use of aggression as an effective instrument in goal achievement (Salmivalli & Peets, 2009). Bully-victims^f are typically described as very aggressive and disruptive (Salmivalli & Peets, 2009) as well as anxious, emotional and hot-tempered (Olweus, 1993; Schwartz et al., 1998). Importantly, bully-victims are the most aggressive group of all children involved in bullying and they demonstrate the highest levels of both proactive and reactive aggression (Salmivalli & Nieminen, 2002). Compared to bullies and victims, the bully-victims stand-out as a group of children most at risk of developing multiple psychopathologic behaviors (Kim, Leventhal, Koh, Hubbard, & Boyce, 2006), and they are most likely to remain involved in bullying for prolonged periods of time (Kumpulainen, Räsänen, & Henttonen, 1999).

EXECUTIVE FUNCTION, SOCIAL COGNITIONS AND INTELLIGENCE

Aggression and behavioral problems tend to manifest more often in children with impaired cognitive skills. For instance, intelligence has been indicated to be one of the cognitive correlates of aggression. A negative relation between IQ and delinquency has been well estab-

^f This group is also often referred to as “reactive victims” or “aggressive victims”.

lished (Fergusson & Horwood, 1995; Hirschi & Hindelang, 1977; Lynam, Moffitt, & Stouthamer-Loeber, 1993; Moffitt, Gabrielli, Mednick, & Schulsinger, 1981). Similarly, it was shown that IQ correlates negatively with aggressive behavior and conduct problems (Huesmann & Eron, 1984; Huesmann, Eron, & Yarmel, 1987; Rutter et al., 2008). Importantly, low IQ exerts most of its effect on early aggression with an onset before age 8 years, and that, in its turn, has implications for child's later intellectual achievement and aggression at later age (Huesmann et al., 1987).

Besides the intellectual abilities, other cognitive skills have been related to aggression. Several studies reported a relation between aggression and poor higher cognitive abilities that are often referred to as executive function (Séguin, Boulerice, Harden, Tremblay, & Pihl, 1999; Séguin, Pihl, Harden, Tremblay, & Boulerice, 1995; Séguin & Zelazo, 2005). Executive function (or conscious control of thought, action and emotion) commonly refers to the self-regulation mechanisms involved in goal-setting and problem-solving processes (Séguin & Zelazo, 2005; Zelazo et al., 2003). These are, for instance, the ability to inhibit behavior, control emotions, plan and organize thoughts and actions. A problem-solving framework proposed by Zelazo and colleagues (Zelazo, Carter, Reznick, & Frye, 1997) identifies four sequential phases of executive function: problem representation, planning, execution and evaluation. Séguin and Zelazo (2005) argue that this framework allows us understand why and at what phase children fail to regulate their physical aggression. Executive function failures at one or several of these phases during peer interactions may set the stage for peer problems. For example, children may fail to represent a problem adequately, or they may be unable to plan and think ahead; children may understand the rules but fail to use these rules, or they may have difficulties evaluating their actions and its impact on others (Séguin & Zelazo, 2005). In addition, at some of these phases, for instance during the problem representation, other cognitive mechanisms, for example children's misconceptions or perception biases, may also play an important role.

The social information-processing approach emphasizes the role of perception biases as triggers of aggression. According to this theoretical model (Crick & Dodge, 1994), aggression can be explained by deficiencies in the social cognitions that are required for solving social problems. Following the social information-processing model, behavior of a child, for instance during a peer conflict, is guided by a chain of thought processes which can be summarized in six sequential steps: perception of external and internal cues, interpretation of these cues, setting the goals, generating possible responses, evaluating and selecting a response, and taking an action and evaluating the chosen response (Crick & Dodge, 1994; Rutter et al., 2008). According to this approach, deficits in information processing at one or more of these steps may trigger social adjustment problems in children.

EXECUTIVE FUNCTION AND ADJUSTMENT PROBLEMS IN CHILDHOOD

As Salmivalli and Peets pointed out, bullying is a group process that depends on *group norms*, and it is often used to achieve or maintain *social status in a peer group* (Salmivalli & Peets, 2009). Bullying can be used to achieve an individual goal, such as power, respect or high social status within a peer group; or it may be used to protect the group's norms, for example by socially excluding unpopular peers to maintain the group's popularity status (Salmivalli & Peets, 2009). Importantly, in order to achieve a goal, for instance a high social status, different children may behave differently (e.g., prosocially vs. aggressively) and use different strategies, depending on their cognitions and beliefs.

However, not all peer aggression is instrumental and proactive. Many children often demonstrate reactive forms of peer aggression (Price & Dodge, 1989). In fact, comparison of children's different bullying involvement roles demonstrated that bullies, victims and bully-victims all show at least some reactive aggression (Salmivalli & Nieminen, 2002). Importantly, this indicates that the victim group should not be considered as completely non-aggressive. Victims score higher on reactive aggression compared to control children, however, victims are not proactively aggressive and they are much less reactively aggressive than bullies and bully-victims (Salmivalli & Nieminen, 2002). Bullies are more proactively and reactively aggressive than victims and controls, however bullies are less aggressive than bully-victims. Finally, the bully-victims have the highest levels of both proactive and reactive aggression (Salmivalli & Nieminen, 2002).

Some studies suggested that bully-victims are more likely to demonstrate reactive aggression as a result of having difficulties regulating their behavior (Schwartz, 2000; Toblin, Schwartz, Gorman, & Abou-Ezzedine, 2005). Bully-victims are often described as impulsive, inattentive and hyperactive (Schwartz, 2000; Toblin et al., 2005). These characteristics could signal co-occurring behavioral problems, such as ADHD. Several studies that examined bullying and victimization experiences of children with ADHD (Holmberg & Hjern, 2008; Kumpulainen, Rasanen, & Puura, 2001; Shea & Wiener, 2003; Timmermanis & Wiener, 2011; Unnever & Cornell, 2003; Wiener & Mak, 2009) found that ADHD symptoms and low self-control of these children are potential risk factors for bullying and for victimization. Yet, it remains unclear to what extent self-regulation problems are associated with bullying and victimization in children without ADHD symptoms.

An association between executive function and aggressive behavior of young children has been reported in several studies. Hughes and colleagues observed preschoolers play with peers and reported that the angry and antisocial behaviors are associated with children's poor executive control, namely poor performance on inhibitory control and planning tasks (Hughes, White, Sharpen, & Dunn, 2000). Children with poor inhibitory control often demonstrate such behaviors as "inappropriate physical responses to others and a tendency to interrupt and disrupt group activities" (Gioia, Espy, & Isquith, 2003, p. 17). Other studies that

examined executive function in preschool and school-aged children also reported an association between poor inhibition skills and aggression (Raaijmakers et al., 2008), and between poor inhibition and planning ability and reactive aggression (Ellis, Weiss, & Lochman, 2009). Similarly, the performance of peer-reported aggressors on inhibition and planning tasks was reported to be rather poor (Monks, Smith, & Swettenham, 2005). Furthermore, planning/organizing and metacognition (i.e., learning, memory) were reported to be associated with bullying (Coolidge, DenBoer, & Segal, 2004), and working memory was shown to be related to physical aggression, even after adjustment for ADHD and IQ (Séguin et al., 1999). Similar evidence can be found in studies of social information-processing. For instance, Crick and Dodge (1994), suggested that maladjusted children may have memory deficits that impair storing or accurately remembering social information, and that socially maladjusted children may have difficulties remembering appropriate social responses or may have cognitive difficulties with constructing new social responses. Also, some findings indicate that executive function skills may interact with children's social information-processing. For instance, Ellis et al. (2009) found that hostile attributional biases moderated the association between children's planning ability and aggression. They have also found that encoding of hostile cues moderated the relation between inhibition and reactive aggression. Similarly, in a study of Carlson et al. (2002) an attribution of a mistaken belief correlated with inhibitory control (Carlson, Moses, & Breton, 2002).

Social-cognitive impairments of bullies, victims and aggressive victims⁹ (i.e., a group of victimized children who demonstrate high levels of reactive aggression) have been described in several studies (Camodeca & Goossens, 2005; Schwartz, 2000; Toblin et al., 2005). In one of these studies it was found that bullies and victims differ from their peers in almost all of the steps of social information-processing (Camodeca & Goossens, 2005). It was concluded that bullies and victims are similar to each other with respect to their reactive aggression and their social-information processing. This suggests that both bullies and victims may have similar social-cognitive deficits.

CURRENT STUDY

While it is clear from the studies of social information-processing that social-cognitive biases may predispose children to bullying involvement (e.g., through hostile attributional biases or selective attention to aggressive cues), little is known about the role of executive function as

⁹ To be consistent in the use of terminology in our manuscript, we will use the concept of "bully-victim" when referring to children who are both victims and bullies, as characteristics of bully-victims come close to the characteristics of the group of children described as "reactive victims" and "aggressive victims" in the social information-processing studies. However, the degree of correspondence between these groups is most probably not complete.

a self-regulation mechanism in bullying and victimization. Are children who fail to regulate their thoughts and behavior more likely to become involved in bullying? Given the findings from previous studies on aggression, it can be assumed that the self-control difficulties may (possibly together with cognitive biases) predispose a child to bullying involvement.

In this prospective study we examine the executive function of bullies, victims and bully-victims. We investigate which domains of executive function (inhibition, shifting, emotional control, working memory or planning/organization) are associated with being a bully, victim or a bully-victim.

Based on studies suggesting a relation between executive function and aggression, we expected that poor executive function would be associated with bullying involvement. Earlier studies have shown a relation between aggression (mainly reactive) and poor inhibition, planning/organization and working memory (Coolidge et al., 2004; Ellis et al., 2009; Raaijmakers et al., 2008; Séguin et al., 1999). Considering that bullies and bully-victims are both reactively and proactively aggressive, and victims are primarily reactively aggressive (Camodeca, Goossens, Terwogt, & Schuengel, 2002; Salmivalli & Nieminen, 2002), we expected that poor executive function would be associated with bullying and victimization. More specifically, the impulsive behavioral style of a child with inhibition problems, such as inappropriate physical responses and disruptive activities in the group, can be perceived by peers as bullying. At the same time, such behavioral style might trigger aggression as a reaction of the peers to the inappropriate behavior of the child. In this way, inhibition problems may predispose a child to victimization, as it is often described in studies of children with ADHD symptoms. Alternatively, inhibition problems may result in a failure to inhibit anxious thoughts, which, in its turn, could make a child more vulnerable to victimization. Thus, we expected that children with inhibition problems would be more likely to be involved in bullying either as bullies, victims or bully-victims.

As described in earlier studies, working memory and planning/organization problems of aggressive children may reflect children's difficulties to remember the appropriate social response strategies or to construct new alternative strategies. Children with such problems may also have difficulties with thinking and planning ahead, or anticipating the negative consequences of their behavioral strategy (Séguin & Zelazo, 2005). This suggests that aggressive behavior of bullies and bully-victims could be associated with their poor working memory and planning/organization skills. We have put this hypothesis to a test by examining the risks of being a bully or a bully-victim in children with poor working memory and poor planning/organization skills.

In sum, we examine whether children's poor executive function, assessed at preschool age, is associated with the peer/self-reported bullying involvement in the first grades of elementary school. We studied this in a large population-based sample while accounting for possible influences of various child and maternal socio-demographic and psychosocial factors. Considering that child IQ is related to early aggression, we examined the effects of IQ on bullying. Additionally, we examined whether IQ did not confound an association between executive

function and bullying involvement. Even though intelligence is often described as being independent of executive function (Pennington & Ozonoff, 1996), IQ is related to aggression and to executive function (IQ scores share variance with measures of executive function), and thus it could confound the studied association. Finally, we examined whether our results are not confounded by children's co-occurring behavioral problems, namely ADHD symptoms, which were shown to be associated with both children's executive function and with bullying involvement.

METHODS

Participants and study design

Thirty-seven elementary schools, with a total of 190 classes, in Rotterdam, the Netherlands participated in the PEERS study assessing children's bullying involvement. Parents of the children from the participating schools were informed about the study by mail and booklets that were distributed to them via teachers. Parents, who did not want their child to participate, were asked to inform a teacher or a researcher before the assessment. In total, 4017 children participated in the study (participation rate: 98%, see Appendix 1 for a flowchart of the sampling procedure). The PEERS Measure assessment was approved by the Medical Ethics Committee of the Erasmus Medical Centre, Rotterdam the Netherlands (MEC-2010-230).

The present study is embedded in the Generation R Study (Jaddoe et al., 2012), a large population-based prospective cohort from fetal life onwards in Rotterdam, the Netherlands. Mothers living in Rotterdam with a delivery date between April 2002 and January 2006, were enrolled in the Generation R Study. Parents of all participants provided written informed consent. The Generation R Study was approved by the Medical Ethics Committee of the Erasmus Medical Centre. Regular extensive assessments have been carried out in children and parents (Tiemeier et al., 2012). The PEERS-data were collected at the time when the oldest Generation R participants were in grades 1-2 of elementary school. Prior to the start of the Generation R phase 3 (from age 5 years onwards), written permission to merge data of the Generation R Study from schools and registries was requested from parents of children participating in the Generation R Study (MEC 2007-413). Out of 4017 children who completed the PEERS-task, parents of 1664 provided consent for participation in at least one of the data collection phases of the Generation R Study in the period between birth and 5 years. Of the 1664 children, 1590 children provided consent for data linkage at age 5 years and onwards. The analyses for the present study were performed in 1377 children for whom data on bullying involvement and either executive functioning or IQ was available.

Bullying and victimization

Peer victimization was assessed in elementary school children at grades 1-2 (mean age 7.68 years, $SD = 9.12$ months) using the PEERS Measure (Verlinden et al., 2013). The PEERS Measure is an interactive computerized instrument that offers a reliable and age-appropriate method of using peer nominations with young children.

Children received instructions from a trained researcher and then completed the assessment independently. Bullying was explained to children as intentional, repeated and continuous actions of peer aggression where victim finds it difficult to defend him/herself (Olweus, 1993). An age appropriate explanation and examples of both bullying and non-bullying behaviors were provided (Verlinden et al., 2013). Four different forms of victimization were assessed: physical (e.g., hitting, kicking, pushing), verbal (e.g., saying mean or ugly things, calling names, teasing), relational (e.g., excluding, leaving out of games) and material (e.g., taking away, breaking or hiding belongings). Children listened to the audio instructions and questions that were accompanied by visual illustrations. Four yes/no questions, each about a different form of victimization, preceded the peer nominations. If a question was answered affirmatively, a child was asked to nominate those classmates who bullied him/her. For instance, to assess physical victimization, children were shown a picture depicting physical bullying, accompanied by an audio explanation of the depicted behavior. Subsequently, children were asked whether their classmates behaved that way towards them, (i.e., often hit, kicked or pushed them). If such question was answered affirmatively, children could click on the photos of the classmates to nominate the children who bullied them.

For each of the bullying questions children received an individual score that was based on the ratings by multiple peers. Considering that a school class consisted on average of 21 children, each child was rated by about 20 classmates with regards to each bullying question. The number of nominations a child gave to the classmates when indicating his/her aggressor(s) was used to calculate individual victimization scores. The number of nominations a child received from the classmates as a bully was used to calculate individual bullying scores. The proportion scores were derived by division of the given/received nominations by the number of children performing the evaluation. Higher scores reflected more bullying or victimization nominations. The scores of four bullying and four victimization questions were averaged to obtain the overall bullying and victimization scores.

Considering that the group of bully-victims is the most problematic group of children among those involved in bullying (Kim et al., 2006; Salmivalli & Nieminen, 2002), we studied children's bullying involvement by categorizing them in different groups. To define the specific bullying involvement roles (i.e., bully, victim and bully-victim), we dichotomized the continuous bullying and victimization scores using the top 25th percentile as cut-off in the sample of all children who were assessed using the PEERS Measure. This cut-off was applied in earlier studies that used a peer-nomination method (Demaray & Malecki, 2003; Veenstra et al.,

2005). The resulting dichotomized measures were then used to categorize children into four non-overlapping groups: uninvolved, bullies, victims and bully-victims.

Executive function and non-verbal IQ

Executive function was assessed in children at the mean age of 4.1 years ($SD = 1.2$ months) using parental questionnaire, the Behavior Rating Inventory of Executive Function-Preschool Version (BRIEF-P) (Gioia et al., 2003). The BRIEF-P is a 63-item questionnaire that assesses different aspects of executive function in preschool children. Parents were asked to report the extent to which their child displayed different behaviors related to executive function within the last month, using answer categories: "Never or not at all", "Sometimes or a little", "Often or clearly". Five empirically derived scales were used to measure children's abilities with respect to the following aspects of executive functioning: (1) inhibition, 16 items assessing child's ability not to act upon impulse (e.g., "Is impulsive"); (2) shifting, 10 items measuring rigidity or inflexibility (e.g., "Has trouble changing activities"); (3) emotional control, 10 items assessing emotional responses to seemingly minor events (e.g., "Mood changes frequently"); (4) working memory, 17 items measuring ability to hold information in mind for the purpose of completing a task (e.g., "Is unaware when he/she performs a task right or wrong"); (5) planning/organization, 10 items assessing ability to anticipate future events and bring order to information, actions or materials in order to achieve a goal (e.g., "Has trouble following established routines for sleeping, eating, or play activities"). The Global Executive Composite (a sum score of the five clinical scales) is a total measure of the executive function. Higher scores on BRIEF-P scales indicate more executive function problems.

Good test-retest reliability and content validity of the BRIEF-P were demonstrated in earlier research (Sherman & Brooks, 2010). In our data, the reliability of the BRIEF-P scales was: .88 for inhibition, .81 for shifting, .84 for emotional control, .89 for working memory scale, .78 for planning/organization problems scale and .95 for the global executive composite scale.

The BRIEF-P is a behavioral measure of executive function. The rating measure of executive function, such as the BRIEF-P, assesses the extent to which children are capable of a goal pursuit and achievement of a goal, while the performance-based measures of executive function reflect children's processing efficiency of cognitive abilities (Toplak, West, & Stanovich, 2013). According to Toplak et al. (2013) both types of measures provide valuable information assessing different aspects of cognitive and behavioral functioning.

An observational measure was used to assess IQ of the children at mean age 6.0 years ($SD = 3.48$ months). Children's non-verbal intellectual abilities were measured using two subtests of a Dutch IQ test: Snijders-Oomen Niet-verbale intelligentie Test Revisie (SON-R 2½-7) (Tellen, Winkel, Wijnberg-Williams, & Laros, 2005). The following test subsets were used as a measure of non-verbal intelligence: Mosaics (assesses spatial visualization abilities of children), and Categories (assesses abstract reasoning abilities in children). Raw scores were derived from these two subtests. The raw scores of each subtest were standardized to reflect a mean

and standard deviation of the Dutch norm population age 2½ - 7 years. The sum of the standardized scores of the two subtests were converted into SON-R IQ score using age-specific reference scores provided in the SON-R 2½ - 7 manual (mean=100, SD=15). The use of the subsets is warranted as the correlation between the IQ scores based on the two subtests and the full SON-R IQ battery was high ($r = 0.86$, Tellegen, personal communication). The average reliability of the SON-R 2½ - 7 IQ score is .90, range 0.86 - 0.92 for the respective age (Tellegen et al., 2005). The reliability of the subtests that were used in our study are: .73 for Mosaics and .71 for Categories.

Covariates

Based on previous studies of executive function, we adjusted our analyses for the following socio-demographic and psychosocial covariates: child age, gender and national origin, attention deficit/hyperactivity problems, internalizing problems, maternal age and national origin, birth order (parity), educational level, monthly household income, marital status, depression symptoms and parenting stress (Dietz, Lavigne, Arend, & Rosenbaum, 1997; Isquith, Gioia, & Espy, 2004; Rubin, Bukowski, & Laursen, 2009). Information about children's date of birth and gender were obtained from midwives and hospital registries. All other covariates were assessed using parental questionnaires. National origin of a child was defined by country of birth of the parent(s) and categorized as Dutch, Other Western or Non-Western (Statistics Netherlands, 2004a).

Children's Attention deficit/hyperactivity problems and Internalizing problems at 36 months were reported by parents using the Dutch version of the Child Behavior Checklist, CBCL1½-5 (Achenbach & Rescorla, 2000; Tick, van der Ende, Koot, & Verhulst, 2007). Examples of the DSM-oriented Attention Deficit/Hyperactivity Problems scale are: "Cannot concentrate, cannot pay attention for long", and "Cannot sit still, restless, or hyperactive". The Internalizing scale consists of four syndrome scales: emotionally reactive (e.g., "Worries"), anxious depressed (e.g., "Fearful"), withdrawn (e.g., "Little affection") and somatic complaints (e.g., "Aches"). All items were rated on a 3-point Likert scale. The CBCL1½-5 has good validity and reliability (Achenbach & Rescorla, 2000; Tick et al., 2007). The reliability of the behavioral problems scales in our sample was .75 for Attention deficit/hyperactivity problems and .82 for Internalizing problems.

Birth order of the child (i.e., parity) was categorized as: "No older sibling in family" and "Older sibling(s) in family". The highest attained educational level of the mother (4 categories) ranged from "Low" (<3 years of general secondary education) to "High" (higher academic education/PhD) (Statistics Netherlands, 2004b). Marital status was categorized as: "Married/living together" and "Single". The net monthly household income comprised the categories: "Less than €1200" (below social security level), "€1200 to €2000" (modal income), and "More than €2000" (above modal income).

Maternal depression symptoms were assessed when children were 3 years old using the Brief Symptom Inventory, a validated instrument containing 53 self-appraisal statements (Derogatis, 1993). A continuous scale consisting of 6 items was used in the analysis, with higher scores representing more symptoms of depression. Cronbach's α for items measuring depression was .99. Parenting stress was assessed when children were 18 months old, using the Nijmeegse Ouderlijke Stress Index-Kort (De Brock, 1992), a questionnaire consisting of 25 items on parenting stress related to parent and child factors. Cronbach's α for the parenting stress scale was .72. The sum scores of the measures were used in the analyses.

Statistical Analysis

We examined whether different domains of child executive function and its overall composite score and child IQ were associated with the risk of being a bully, victim or a bully-victim (reference group: uninvolved). For our main analyses, two multilevel logistic regression models were analyzed: a univariate model and a model adjusted for socio-demographic and psychosocial covariates (Tables 2-4).

In additional analyses, the association between executive function and bullying involvement was additionally adjusted for IQ to examine whether any effect of executive function was independent of IQ. To this aim, we added IQ as a covariate to the adjusted models presented in Tables 2-4. Likewise, all analyses of executive function and bullying involvement were additionally adjusted for ADHD symptoms. The aim of this analysis was to test whether ADHD symptoms underlie the observed association. To adjust for the ADHD problems we added the scores of the CBCL DSM-oriented Attention Deficit/Hyperactivity Problems scale to the adjusted models presented in Tables 2-4.

The scores of the BRIEF-P scales were *SD*-standardized (scores were divided by standard deviations), thus the effect estimates can be interpreted as an increase in odds of bullying involvement per standard deviation increase in problems on executive function scale. In order to confirm the consistency of the findings obtained using the categorical measure of bullying involvement, we additionally performed the same analyses using the continuous scales of bullying and victimization.

Missing data were estimated using multiple imputation technique (chained equations using STATA) (Stata/SE 12.0, StataCorp LP Texas). All covariates were used to estimate the missing values and the reported effect estimates are the product of the pooled results. In order to account for the clustered structure of the data (i.e., on average six children from the same school classes were included in the analyses), we performed multilevel regression analyses using school class as a grouping variable.

Non-response analyses

Our study sample included the Generation R Study participants with the peer/self-reports of bullying involvement ($N=1552$) for whom data on at least one of the five BRIEF-P scales or the

IQ measure were available ($n=1377$). These 1377 children were compared to those with missing data on all the BRIEF-P scales and IQ ($n=175$). Data were missing more often in children of non-Western national origin (16.1% vs. 6.3%, $p<.001$). Mothers of children with missing data were on average younger (mean difference 2.6 years, $p<.001$) more often lower educated (12.9% vs. 4.8%, $p<.001$), and more often single (16.5% vs. 7.8%, $p=.001$).

RESULTS

Sample characteristics

Child and maternal characteristics are presented in Table 1. Bullying and victimization were assessed at the mean age of 7.68 years ($SD=9.12$ months). Our sample comprised 48.3% of boys, and 59.6% of children of Dutch national origin. Sixty-seven percent of children were categorized as uninvolved in bullying, 11.8% as bullies, 14.1% as victims and 7.3% as bully-victims.

Executive functioning and bullying involvement

We examined whether child executive function problems in areas of inhibition, shifting, emotional control, working memory or planning/organization were associated with bullying involvement in early elementary school. We analyzed the risks of bullying involvement for each outcome separately: bully, victim, and bully-victim (reference group: uninvolved). Adjustment of the analyses for the child and maternal covariates attenuated some of the effect estimates (Tables 2-4). For reasons of brevity, we discuss only the results obtained from the adjusted analyses.

First, we studied the association of executive function and child IQ with a risk of being a bully. As shown in Table 2, the risk of being a bully was higher in children with inhibition problems (OR per $SD=1.35$, $95\%CI$: 1.09-1.66). The effects of working memory were marginally significant (OR per $SD=1.29$, $95\%CI$: 0.97-1.72). Next, we examined the association between executive functioning and the risk of being a victim (Table 3). *Peer victimization* was predicted by inhibition problem score (OR per $SD=1.21$, $95\%CI$: 1.00-1.45). None of the other domains of executive function were associated with peer victimization after adjustment for the covariates. Child IQ was related to a lower risk of victimization ($OR=0.99$ per SD , $95\%CI$: 0.98-1.00). The risks of being a bully-victim in relation to child's executive function are presented in Table 4. Children with inhibition problems showed an increased risk of being a bully-victim (OR per $SD=1.55$, $95\%CI$: 1.10-2.17). Also, children with higher IQ scores were less likely to be a bully-victim ($OR=0.95$, $95\%CI$: 0.93-0.98).

In additional analyses we examined whether the association between executive function and bullying involvement is independent of child IQ and ADHD problems. Additional adjustment of the association between executive function and bullying involvement for non-verbal

Table 1. Sample characteristics

Child characteristics	<i>N</i>	<i>M (SD)¹</i>	<i>Min – Max</i>
Age child, y	1377	7.68 (9.12)	5.75 – 9.88
Gender (boys, %)	1377	48.3	
National origin (%)			
Dutch	821	59.6	
Other Western	149	10.8	
Non-western	375	27.2	
Bullying involvement ² (%)			
Uninvolved	920	66.8	
Bully	163	11.8	
Victim	194	14.1	
Bully-victim	100	7.3	
Executive function problems ³ (total score on BRIEF-P)	1045	85.20 (15.16)	63 – 147
Inhibition problem score	1039	22.16 (4.99)	16 – 42
Shifting problem score	1052	13.61 (3.22)	10 – 30
Emotional control problem score	1052	14.25 (3.38)	10 – 27
Working memory problem score	1042	21.53 (4.61)	17 – 39.31
Planning/organization problem score	1050	13.65 (2.96)	10 – 25.56
Internalizing problems ⁴	1014	4.86 (4.70)	0 – 36
Externalizing problems ⁴	1013	7.94 (5.91)	0 – 40
Attention deficit / hyperactivity problems	1017	2.75 (2.21)	0 – 12
IQ score ⁵	1201	101.94 (14.62)	55 – 147
Maternal characteristics			
Age mother (at intake), y	1377	31.65 (4.61)	15.35 – 46.34
National origin (%)			
Dutch	796	57.8	
Other Western	183	13.29	
Non-western	366	26.58	
Educational level (%)			
Low	193	15.2	
Mid-low	382	30.2	
Mid-high	320	25.3	
High	371	29.3	
Monthly household income (%)			
Less than €1200 (approximately US \$1500)	156	14.2	
€1200 to €2000 (approximately US \$1500-\$2500)	190	17.3	
More than €2000 (approximately US \$2500)	750	68.4	
Maternal marital status (single, %)	1265	10.4	
Maternal depression symptoms ⁶	1009	0.13 (0.32)	0 – 2.67
Parenting stress ⁷	1025	0.32 (0.29)	0 – 2.45
Older sibling(s) in family (%)	1377	46.9	

Note.

¹ Unless otherwise indicated.

² Bullying involvement was assessed at age 8 years using the PEERS Measure.

³ Executive functioning was assessed at age 4 years with the BRIEF-P, the Behaviour Rating Inventory of Executive Function-Preschool Version.

⁴ Behavioral problems were assessed at age 3 years with CBCL/1½-5, the Dutch version of the Child Behaviour Checklist.

⁵ Non-verbal intellectual abilities were assessed at age 5 years using two subtests of a Dutch IQ test: Sijnders-Oomen Niet-verbale intelligentie Test Revisie (SON-R 2½-7).

⁶ Depression symptoms were measured with the Brief Symptom Inventory.

⁷ Parenting stress was measured with Nijmeegse Ouderlijke Stress Index – Kort.

Table 2 Child executive functioning and bullying in early elementary school ($n=1083$)

Executive functioning	Risk of being a bully			
	Univariate model		Adjusted for covariates ^a	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Domains of executive functioning (per SD)				
Inhibition problem score	1.52 (1.25-1.84)	<0.001	1.35 (1.09-1.66)	0.005
Shifting problem score	1.02 (0.80-1.30)	0.86	0.94 (0.72-1.22)	0.61
Emotional control problem score	1.13 (0.93-1.38)	0.22	1.05 (0.84-1.32)	0.64
Working memory problem score	1.45 (1.14-1.84)	0.004	1.29 (0.97-1.72)	0.08
Planning/organization problem score	1.24 (0.96-1.60)	0.10	1.10 (0.86-1.41)	0.45
Global scores				
Global executive composite (per SD)	1.45 (1.16-1.80)	0.001	1.24 (0.97-1.60)	0.09
Child IQ score	0.98 (0.97-0.99)	0.006	0.99 (0.97-1.00)	0.16

Note.

Analyses were conducted in 1083 of 1377 children ('uninvolved' $n=920$, 'bully' $n=163$), children categorized as 'victim' ($n=194$) and 'bully-victim' ($n=100$) were not included in this analysis.

Bullying is peer-reported. Peer nomination scores were based on ratings by multiple peers. Higher scores on BRIEF-P subscales denote more problems.

^aAdjusted for: child age, gender and national origin; maternal age, national origin, parity, education, income, marital status, depression symptoms and parenting stress.

Table 3. Child executive functioning and victimization in early elementary school ($n=1114$)

Executive functioning	Risk of being a victim			
	Univariate model		Adjusted for covariates ^a	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Domains of executive functioning (per SD)				
Inhibition problem score	1.15 (0.96-1.38)	0.14	1.21 (1.00-1.45)	0.05
Shifting problem score	0.98 (0.84-1.15)	0.84	0.99 (0.82-1.18)	0.89
Emotional control problem score	1.04 (0.87-1.23)	0.68	1.07 (0.89-1.27)	0.48
Working memory problem score	0.99 (0.80-1.23)	0.94	1.00 (0.78-1.27)	0.99
Planning/organization problem score	1.02 (0.82-1.26)	0.84	1.02 (0.83-1.27)	0.82
Global scores				
Global executive composite (per SD)	1.06 (0.89-1.26)	0.51	1.10 (0.90-1.35)	0.36
Child IQ score	0.98 (0.97-0.99)	0.003	0.99 (0.98-1.00)	0.04

Note.

Analyses were conducted in 1114 of 1377 children ('uninvolved' $n=920$, 'victim' $n=194$), as children categorized as 'bully' ($n=163$) and 'bully-victim' ($n=100$) were not included in this analysis.

Victimization is self-reported. Higher scores on BRIEF-P subscales denote more problems.

^aAdjusted for: child age, gender and national origin, internalizing problems; maternal age, national origin, parity, education, income, marital status, depression symptoms and parenting stress.

Table 4. Child executive functioning and bullying-victimization in early elementary school ($n=1020$)

Executive functioning	Risk of being a bully-victim			
	Univariate model		Adjusted for covariates ^a	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Domains of executive functioning (per SD)				
Inhibition problem score	1.62 (1.22-2.15)	0.001	1.55 (1.10-2.17)	0.01
Shifting problem score	0.94 (0.53-1.65)	0.80	0.88 (0.49-1.58)	0.62
Emotional control problem score	1.20 (0.83-1.72)	0.32	1.21 (0.80-1.83)	0.35
Working memory problem score	1.32 (0.90-1.91)	0.14	1.18 (0.72-1.94)	0.47
Planning/organization problem score	1.31 (0.88-1.94)	0.17	1.17 (0.77-1.78)	0.43
Global scores				
Global executive composite (per SD)	1.46 (1.08-1.96)	0.01	1.34 (0.91-1.97)	0.13
Child IQ score	0.94 (0.93-0.96)	<0.001	0.95 (0.93-0.98)	<0.001

Note.

Analyses were conducted in 1020 of 1377 children, as children categorized as 'bully' ($n=163$) and 'victim' ($n=194$) were not included in this analysis.

Bullying is peer-reported, victimization is self-reported. Peer nomination scores were based on ratings by multiple peers. Higher scores on BRIEF-P subscales denote more problems.

^aAdjusted for: child age, gender and national origin; maternal age, national origin, parity, education, income, marital status, depression symptoms and parenting stress.

IQ yielded essentially identical results to those presented above. For example, the additional IQ adjustment of the association between inhibition problems and risk of being a bully resulted into OR per $SD=1.34$, $95\%CI$: 1.09-1.65 (other data not presented). This demonstrates that the association between child executive function and bullying involvement is mostly independent of child non-verbal IQ. An additional adjustment of the association between executive function and bullying involvement for ADHD symptoms only marginally changed our results. For example, effects of inhibition problems became: OR_{bully} per $SD = 1.39$, $95\%CI$: 1.10-1.77; OR_{victim} per $SD = 1.17$, $95\%CI$: 0.95-1.45, and $OR_{bully-victim}$ per $SD = 1.47$, $95\%CI$: 1.01-2.13 (other data not presented).

Finally, we performed the same analyses using continuous measures of bullying and victimization. The results obtained for bullying and victimization scales were in line with those obtained from the analyses using categorical measures (see supplementary Tables 1-2), with the exception of the effects of working memory and IQ on bullying, which remained statistically significant in the fully adjusted model (supplementary Table 1). The coefficients in these additional analyses represent unstandardized betas. Furthermore, the BRIEF-P scales were SD -standardized and bullying and victimization scales were transformed using square root transformation to normalize the distribution. In the continuous analyses it was not possible to distinguish the group of bully-victims; therefore the results of the continuous analyses for bullies and victims partly reflect the risk associated with being a bully-victim.

DISCUSSION

In this study we sought to test the hypothesis that child executive function at preschool age is associated with bullying involvement in early elementary school, and examine whether this association is independent of child non-verbal IQ and ADHD problems. Our results suggest that children with inhibition problems, observed by a parent at the age 4 years, are at risk of being a bully, victim or a bully-victim in the first grades of elementary school. Further, a higher risk of being a bully was associated with working memory problems. Conversely, children with higher IQ scores were less likely to be victims and bully-victims in early elementary school.

With regard to executive function, our most conspicuous finding was that inhibition problems predicted children's bullying involvement as a bully, as a victim and as a bully-victim. The observed associations were not confounded by child and maternal socio-demographic and psychosocial covariates. Additional adjustment for IQ showed that the effect of inhibition is independent of non-verbal intelligence. Finally, the results hardly changed after additional adjustment for ADHD problems, except for the group of victims in which the effect estimate was no longer statistically significant.

A negative association between inhibition and aggressive behavior (mainly reactive) has been reported in earlier studies of young children (Ellis et al., 2009; Hughes et al., 2000; Raaijmakers et al., 2008). Bullies, bully-victims, and to some extent also victims, display reactive aggression (Camodeca et al., 2002; Salmivalli & Nieminen, 2002). Our results suggest that bullying involvement, most likely in a form of reactive aggression, could be related to children's poor inhibitory control. In other words, children's involvement in bullying may be partly due to their impeded self-control. Consider a situation involving social conflict. A failure to inhibit behavioral responses or to delay immediate verbal or physical actions in order to think ahead and choose the most appropriate behavioral strategy, may explain why these children are more likely to have problems with their peers. Our results suggest that poor inhibition may increase children's risk of bullying involvement. These findings are in line with the studies showing that inhibition problems may increase the likelihood of children's externalizing and internalizing problems (Nigg, Quamma, Greenberg, & Kusche, 1999) and aggression (Ellis et al., 2009; Raaijmakers et al., 2008).

In some of the previous studies of executive function, problematic behavioral outcomes were attributed to children's ADHD symptoms. In particular, impulsivity and inhibition problems are typical characteristics of children with ADHD symptoms. ADHD symptoms have been associated with bullying and victimization in several studies (Holmberg & Hjern, 2008; Kumpulainen, Rasanen, & Puura, 2001; Shea & Wiener, 2003; Timmermanis & Wiener, 2011; Unnever & Cornell, 2003; Wiener & Mak, 2009). However, in our study we showed that the effect of inhibition problems in bullies and bull-victims was largely independent of the attention deficit/hyperactivity problems, as the observed associations attenuated only slightly after adjustment for ADHD problems. Similarly, Raaijmakers et al. (2008) reported an association

between aggressive behavior of preschool children and their inhibition deficits irrespective of children's attention problems.

Children with working memory problems had a higher risk of being a bully; although, this finding was only marginally significant. Children with working memory problems have more difficulties holding information in mind that is needed to undertake an action. Poor working memory function results in difficulties implementing a required action and in difficulties remembering rules (Gioia et al., 2003). This suggests that these children struggle with remembering or implementing an appropriate behavioral strategy. Children who struggle with adhering to the group norms and rules may engage more often in bullying. Also, based on the social information-processing model, difficulties in recognizing social cues relevant for peer interactions, or difficulties remembering appropriate social responses (Crick & Dodge, 1994), can influence child's behavior during a peer conflict. The observed effect of working memory on bullying is consistent with several earlier research findings. For instance, in a small study of 11-15 year-olds (Coolidge et al., 2004), metacognitive dysfunctions, such as problems with reading, memory and concentration, were found to be correlated with bullying. Furthermore, previous studies in older children (Séguin et al., 1999) and in young adults (Séguin, Nagin, Assaad, & Tremblay, 2004) reported a relation between poor working memory and physical aggression.

In earlier studies (Coolidge et al., 2004; Ellis et al., 2009), child planning ability was related to bullying and to reactive aggression. However, these studies used small samples and examined the association in somewhat older children. Furthermore, the associations in these studies were not adjusted for important confounders, such as maternal educational level. In our study, the association between planning/organization and bullying (continuous analyses, see supplementary Table 1) was confounded by child and maternal covariates. Our hypothesis with regard to the effect of planning/organization on peer aggression could thus not be confirmed. This emphasizes the importance of considering many potential confounders, such as for instance maternal educational level, when studying the association between child executive function and behavioral outcomes.

The finding that that emotional control problem score was not associated with bullying involvement was almost counterintuitive. On the other hand, there is little prior evidence for such association in earlier studies of the effects of executive function on aggression. Children with emotional control problems are emotionally explosive, moody and they often demonstrate exaggerated emotional reactions (Gioia et al., 2003). However, bullying is not necessarily seen as an emotional outburst; instead it is thought to be an intended and repeated aggression towards peers (Olweus, 1993). Emotional arousal or anger are not the essential prerequisites of bullying (Salmivalli & Nieminen, 2002), which could be a possible explanation of why emotional control problems and bullying were not associated.

Our final goal was to examine whether there was an effect of IQ on the risk of bullying involvement. It is well established that intelligence is protective against antisocial behavior and

delinquency (Kandel et al., 1988; Lynam et al., 1993; White, Moffitt, & Silva, 1989). Also, previous research in young children showed that IQ is negatively associated with child aggression (Huesmann et al., 1987). Our findings suggest that children with higher non-verbal IQ are less likely to be involved in bullying as victims and as bully-victims. Heusmann et al. (1987) suggested that “the lower IQ children do not possess the cognitive skills necessary to learn the more complex nonaggressive social problem-solving skills”. Thus a child with weaker intellectual abilities may struggle with conceiving alternative, less aggressive strategies for obtaining his or her goals. It could be that bully-victims persistently use aggressive strategies for their goal achievement and they may struggle with changing their behavior. Furthermore, Heusmann et al. (1987) noted that regardless of the effects of aggressive strategies, the aggressive behavior of a child is likely to persist if this child is not able to learn to construct or to remember an alternative behavioral strategy. Furthermore, it has been suggested that “lower IQ may make success at any endeavor more difficult for the child, resulting in increased frustration, lower self-esteem and stimulated aggression” (Huesmann et al., 1987). In this way, lower IQ may undermine children’s functioning making them more vulnerable to peer problems. In our study, a negative association was observed between non-verbal IQ and the risk of being a victim. This could mean that children with higher IQ are more skilled in either preventing peer victimization or in effective resolution of peer conflicts.

Strengths, limitations and methodological considerations

The aim of our study was to describe the association between child executive functioning and school bullying involvement using a population-based sample and controlling for several possible confounders. A large sample size, the use of parent report of executive functioning in combination with the peer/self-report of bullying involvement, along with an observational measure of child IQ, are the strengths of this study. Furthermore, we were able to describe the association between child executive functioning and bullying involvement for different bullying involvement roles (i.e., bullies, victims, and bully-victims vs. uninvolved).

Nevertheless, our study has some limitations which could be addressed in future studies. First, experimental and longitudinal data should be used to establish a temporal relation between executive functioning and bullying involvement. Executive function was assessed at the age of 4 years, when children are under a close supervision of an adult for most of the time, and at this age they are less likely to be involved in bullying. However, although children do not attend school at this age, the possibility of child’s involvement in bullying prior to the school entry cannot be ruled out. Future studies could address this by examining repeated measures of executive function and bullying. Second, the non-response analyses suggested some selection effects in the sample of the Generation R participants. This may have influenced the generalizability of our findings.

Two methodological considerations should be noted. First, we used a peer-nomination method to collect information about children’s bullying involvement. In our study victimiza-

tion scores were calculated based on the number of the nominations children gave to their classmates when nominating their offenders. This is different from the questionnaire methods and from the methods requiring children nominate the victims in their class. We asked children to report about their own experience of victimization and to nominate their aggressors. It was shown that at young age, self-reports of victimization are more accurate than the reports of peers about victimization of other children; whereas peer reports of aggression are more consistent than the self-reports of aggression (Österman et al., 1994). Based on the percentile cut-off used in previous studies, we categorized the bullying and victimization scores in order to define the groups of bullies, victims and bully-victims. However, this categorization is relative as children who are defined as “uninvolved” differ from those who are categorized as bullies, victims or bully-victims mainly in the severity of bullying or victimization.

Second, in our study we measured executive function using a behavioral rating scale. As discussed by Toplak et al. (2013), performance-based and rating measures of executive function assess different cognitive and behavioral aspects. The performance-based assessments measure children’s efficiency of cognitive abilities, while the rating assessments, such as the BRIEF-P, measure a child’s ability to pursuit and achieve a goal. Goal pursuing is an important aspect in the context of our study and thus we deemed this measure of executive function suitable for our study.

In sum, we examined an association between child executive functioning and the risk of bullying involvement in early elementary school using a population-based sample. Our results showed that children who have inhibition problems are more likely to be bullies, victims and bully-victims in the first grades of elementary school. Also, working memory problems appear to be associated with the risk of being a bully. Finally, children with higher non-verbal IQ are less likely to be victims and bully-victims. These findings suggest that peer interactions may be to some extent influenced by children’s executive function and non-verbal intelligence. Future studies should examine whether addressing executive function skills can improve the quality of peer interactions.

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SUPPLEMENTARY MATERIAL

Supplementary Table 1 Child executive functioning and bullying in early elementary school ($n=1377$)

	Bullying score			
	Univariate model	Adjusted for covariates ¹		
Executive functioning	<i>B</i> (95% <i>CI</i>)	<i>p</i> -value	<i>B</i> (95% <i>CI</i>)	<i>p</i> -value
Domains of executive functioning (per SD)				
Inhibition problem score	0.018 (0.010-0.027)	<0.001	0.010 (0.002-0.018)	0.01
Shifting problem score	0.001 (-0.006-0.008)	0.74	-0.003 (-0.010-0.004)	0.41
Emotional control problem score	0.006 (-0.001-0.014)	0.10	0.003 (-0.003-0.010)	0.40
Working memory problem score	0.017 (0.009-0.025)	<0.001	0.009 (0.002-0.017)	0.02
Planning/organization problem score	0.012 (0.001-0.024)	0.03	0.004 (-0.004-0.012)	0.27
Global scores				
Global executive composite (per SD)	0.018 (0.010-0.025)	<0.001	0.008 (0.001-0.015)	0.04
Child IQ score	-0.002 (-0.002- -0.001)	<0.001	-0.001 (-0.001- -0.001)	<0.001

Note.

$n=1377$. Bullying is peer-reported. Peer nomination scores were based on ratings by multiple peers.

Presented coefficient: unstandardized *B* derived from multilevel linear regression analyses. Bullying scale was transformed using square root transformation.

¹Adjusted for: child age, gender and national origin; maternal age, national origin, parity, education, income, marital status, depression symptoms and parenting stress.

Supplementary Table 2 Child executive functioning and victimization in early elementary school ($n=1377$)

	Victimization score			
	Univariate model	Adjusted for covariates ¹		
Executive functioning	<i>B</i> (95% <i>CI</i>)	<i>p</i> -value	<i>B</i> (95% <i>CI</i>)	<i>p</i> -value
Domains of executive functioning (per SD)				
Inhibition problem score	0.016 (0.004-0.027)	0.007	0.015 (0.004-0.025)	0.009
Shifting problem score	-0.003 (-0.013-0.007)	0.53	-0.005 (-0.013-0.003)	0.20
Emotional control problem score	0.005 (-0.006-0.015)	0.38	0.004 (-0.007-0.014)	0.49
Working memory problem score	0.008 (-0.003-0.018)	0.16	0.005 (-0.007-0.016)	0.42
Planning/organization problem score	0.006 (-0.008-0.020)	0.36	0.003 (-0.009-0.014)	0.63
Global scores				
Global executive composite (per SD)	0.010 (-0.001-0.021)	0.07	0.007 (-0.004-0.018)	0.23
Child IQ score	-0.002 (-0.003- -0.001)	<0.001	-0.001 (-0.002- -0.001)	<0.001

Note.

$n=1377$. Victimization is self-reported.

Presented coefficient: unstandardized *B* derived from multilevel linear regression analyses. Victimization scale was transformed using square root transformation.

*Adjusted for: child age, gender and national origin; maternal age, national origin, parity, education, income, marital status, depression symptoms and parenting stress.

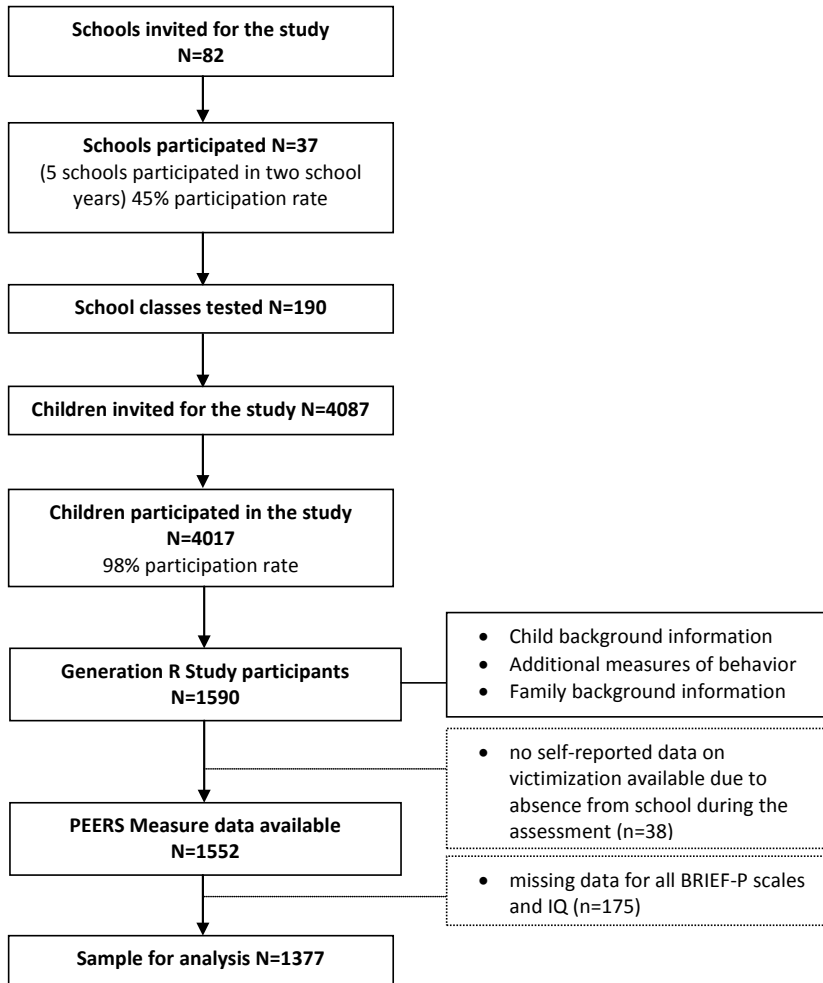


Figure S1. Flowchart of the sampling procedure

Chapter 7

Teacher and peer reports of overweight and bullying among young primary school children

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ABSTRACT

Introduction: Overweight is a potential risk factor for peer victimization in late childhood and adolescence. The present study investigated the association between body mass index (BMI) in early primary school and different bullying involvement roles (uninvolved; bully; victim; bully-victim) as reported by teachers *and* children themselves.

Methods: In a population-based study in the Netherlands, measured BMI and teacher-reported bullying behavior were available for 4364 children (mean age=6.2 years). In a subsample of 1327 children, a peer nomination method was used to obtain child reports of bullying.

Results: In both teacher- and child-reported data, a higher BMI was associated with more victimization and more bullying perpetration. For instance, a one point increase in BMI was associated with a 0.05 increase on the standardized teacher-reported victimization score (95% CI: 0.03; 0.07, p -value<0.001). Combining the victimization and bullying scores into different types of bullying involvement showed that children with obesity, but not children with overweight, had a significantly higher risk to be a bully-victim (OR=2.25, 95%CI: 1.62; 3.14) than normal-weight peers.

Conclusions: At school entry, a high BMI is a risk factor associated with victimization and bullying perpetration, with in particular obese children likely to be victims and aggressors. Results were consistent for teacher and child reports of bullying, supporting validity of our findings. Possibly, obesity triggers peer problems, but the association may also reflect a common underlying cause that makes obese children vulnerable to bullying involvement.

INTRODUCTION

About 25% of children and adolescents in Western countries are overweight.^{1,2} Childhood overweight has several short-term consequences for children's well-being, as it predicts depressive symptoms, poor self-esteem, stigmatization and being bullied by peers.^{3,4} Bullying is characterized by a repeated aggression in which a person intends to harm or disturb another person and can take various forms, such as hitting, name calling, gossiping and social exclusion.⁵ School bullying is a widespread phenomenon with a negative impact on children's mental health and school functioning.^{6,7} Additionally, being victimized may also affect children's lifestyles and lead to obesogenic behaviors, like avoiding (social) activities and sports, and binge eating in response to distress.⁸ This suggests children may become entrapped in a downward spiral of overweight leading to victimization, which in turn worsens weight problems through unhealthy lifestyle behaviors.

Several studies demonstrated that school-age children and adolescents with overweight are relatively often a victim of weight-related bullying but also of other forms of bullying behavior.⁹⁻¹⁶ Using data from a population-based cohort in the U.K., Griffiths and colleagues reported that obese boys and girls in middle childhood were about 1.5 times more likely to be victimized than their normal weight counterparts.¹¹ Likewise, a large Canadian study showed that adolescents with overweight, particularly those with obesity, were at high risk of relational and verbal victimization.¹² Previous research mainly focused on victimization, but Griffiths *et al.* and Janssen *et al.* also assessed bullying perpetration and found that boys with a relatively high body weight were likely to be a bully.^{11,12} This could reflect physical strength and dominance of heavyset boys, but bullying may also be an expression of reactive aggression in response to being victimized. Scientists typically refer to children who are both a victim *and* a bully as bully-victims. These so-called bully-victims have a very high risk of later psychosocial problems.¹⁷ As it is unclear whether body mass index (BMI) is associated with bully-victimization, research assessing both victimization *and* bullying is needed to examine different bullying involvement roles among children with overweight.

Previous research on weight status and bullying behavior was also limited in a few other aspects. Except for one study,¹³ research mostly relied on self-reported victimization and on self-reported rather than objectively measured weight and height.^{9-12,14-16} Consequently, reported associations may be overestimated due to negative self-evaluation bias: children with a poor self-esteem may be more likely to perceive mild teasing as victimization and plausibly also have a distorted self-image. Another important gap in the literature is the lack of studies in an age group *before* middle childhood (age 8-9 years), whereby it remains unknown whether overweight predisposes children to victimization already at school entry. The high prevalence of overweight^{1,2,18} as well as the commonness of bullying behavior in early primary school¹⁹ calls for research to address this knowledge gap. Additionally, the notion that bullying may exacerbate the level of overweight in children or further harm their self-esteem,

strengthens the importance of intervening as early as possible, before a downward spiral is initiated.

The objective of our study was to examine whether overweight/obesity is associated with victimization and bullying perpetration among 5-6 year old children in the first grades of primary school. We applied a multi-informant approach using teacher and child reports of bullying behavior to determine consistency of associations across informants. We hypothesized that a high BMI predisposes to victimization and bullying perpetration. Specifically, we postulated that overweight and obese children are more likely to be involved in bullying, in particular in *physical* bullying, than their normal-weight peers.

METHODS

Design

This cross-sectional study was embedded in Generation R, a population-based cohort from fetal life onwards.^{20,21} Pregnant women living in Rotterdam, the Netherlands, with an expected delivery date between April 2002 and January 2006 were invited to participate during pregnancy and after birth of their child (participation rate: 61%). Written informed consent was obtained from all participating children and their parents, and the Medical Ethics Committee of the Erasmus University Medical Centre approved the study. The information used in the current study was obtained around school entry, by hands-on measurements, postal questionnaires and a peer nomination procedure. Teacher reports of bullying were collected by the Municipal Public Health Service as part of routine health examinations. The Medical Ethical Committee of the Erasmus University approved the scientific use of this data and Generation R participants gave consent for data linkage.

Study population

Information on weight status at school entry was available for 6690 children (mean age: 6.2 years). School teachers of these children filled out a questionnaire that included questions about child bullying involvement at school. Only teachers of children still residing in Rotterdam were approached (n=5743, see also Figure 1). Teacher response was 76%, resulting in a study population of 4364 children with data on weight status and teacher-reported bullying behavior. These children attended 1661 different school classes; the mean number of Generation R participants per school class was 2.6 (interquartile range: 3-8). In a subsample of the Generation R participants and their classmates, child reports of bullying were obtained with a peer-nomination measure. Child reports of bullying were available for 1327 children (attending 186 different school classes) for whom weight data were also available.

In a non-response analysis, we compared eligible children with (n=4364) and without (n=1379) a teacher report. No differences in national origin (p=0.46), maternal educational level (p=0.17) and child BMI (p=0.92) were found between the two groups.

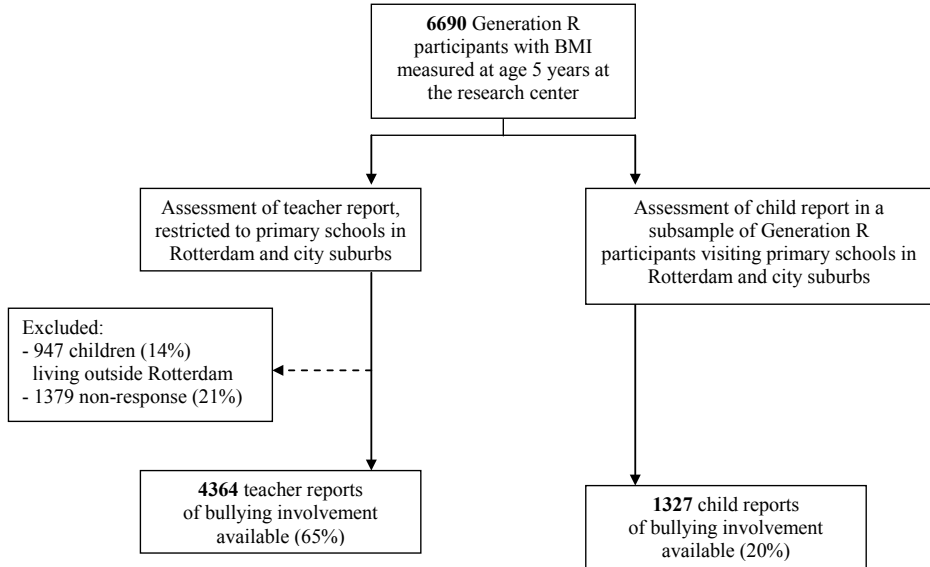


Figure 1. Selection of study population.

In a subsample of 1102 children, both teacher and child reports of bullying involvement were available.

Measures

Bullying and victimization

Teachers rated the occurrence of four common forms of bullying and victimization^{19,22} for each Generation R participant in their class. The victimization items assessed whether: 1) 'child was physically victimized by peers, e.g. being hit, kicked or pinched' (physical victimization); 2) 'child was verbally victimized, e.g. being teased, laughed at or called names' (verbal victimization); 3) 'whether child was excluded by peers' (relational victimization); and 4) 'whether belongings of child were hidden or broken' (material victimization). Four analogous items were used to assess the same forms of bullying perpetration, e.g. 'Whether child physically bullied peers'. Each item was rated on a four-point rating scale with 0=less than once a month, 1=1-3 times per month, 2=1-2 times per week and 3=more than twice a week. Scale scores of victimization and bullying were calculated by summing the four items of each scale. As per existing precedents,^{19,22} children with a 'less than once a month'-rating (0) on all four bullying and four victimization items were classified as uninvolved children. Children were classified as victims if they had a rating of 1 or more on any of the four victimization items. Likewise, children were classified as bullies if they had a rating of 1 or more on any of the four bullying perpetration items. Children meeting the criteria of both bullies *and* victims were categorized as bully-victims.^{19,22}

Child reports of bullying involvement were obtained using the PEERS Measure, a computerized peer-nomination assessment.²³ As in the teacher assessment, four forms of victimiza-

tion (physical, verbal, relational, material) were assessed using analogous questions to those described above, supported by visual images.²³ Children could nominate those who bullied them by clicking on the photos of classmates on the screen. The number of nominations a child gave to others was used to calculate individual victimization scores. The nominations each child received from his/her classmates were used to calculate individual bullying scores. The nomination scores were weighted by the number of children performing the PEERS task. To identify bullies, victims and bully-victims, the continuous victimization and bullying scores were dichotomized using the top 25th percentile as cut-off, as was done in previous studies.²⁴ Children were then categorized into the non-overlapping groups: uninvolved, bullies, victims and bully-victims. Although the peer-nomination assessment was done in complete school classes, the current study only used scores of children participating in Generation R. Previously, we demonstrated good internal consistency ($\alpha=0.79$ and 0.73 , respectively) and test-retest reliability (intraclass correlation coefficients= 0.78 and 0.67 , respectively) for the bullying and victimization scales.²³

Despite substantial overlap between teachers and children (75% agreed on being a victim, 74% on being a bully), the interobserver agreement was low ($\kappa=0.12$, $n=1102$ with both reports available). While cross-informant agreement in bullying research is typically low due to different reporters' perspectives,²⁵ further methodological differences (different instruments and assessment points) certainly account for the low agreement as well.

Body mass index (BMI)

Children's weight and height were measured by trained staff at our research center. BMI (kg/m^2) was used to classify children as having 'normal weight' (including underweight), 'overweight' or 'obesity' according to international age- and gender-specific criteria.²⁶

Covariates

Several sociodemographic variables (child gender, national origin and age; maternal educational level; single parenthood; presence of siblings) were considered as possible confounders, as they were previously linked with children's bullying behavior.^{19,23}

Statistical analyses

The teacher- and child-reported victimization and bullying scores were square root transformed to approach a normal distribution, then standardized to allow comparability. To optimize statistical power, the relation of BMI with teacher- and child-reported victimization and bullying scores was first examined with linear regression analyses. Two-way BMI-gender interactions were tested in these analyses. Next, logistic regression analyses were conducted to examine the association between weight status and different bullying involvement roles. We calculated odds ratios (ORs) for each bullying role (victim, bully, bully-victim) as compared to uninvolved children.

Data were analyzed in a two-level structure to account for children clustered within school classes. We present unadjusted results and results adjusted for possible confounding variables. Multiple imputation techniques (chained regression) were used to replace missing values of the confounders based on available information on all variables included in this study.²⁷ The reported effect estimates are the pooled results of forty imputed datasets. All analyses were conducted in STATA 11.0 (Stata Corporation, College Station, Texas).

Table 1. Characteristics of the study population

Child characteristics	Children with teacher report data of bullying (N=4364)		Children with self/peer report data of bullying (N=1327) ^a	
	N ^b	%	N	%
Gender (% boys)	2206	50.6	645	48.6
National origin				
Dutch	2313	54.5	776	60.0
Other Western	379	8.9	143	11.0
Non-western	1549	36.5	375	29.0
Weight status				
Normal weight	3526	80.8	1106	83.4
Overweight	595	13.6	161	12.1
Obese	243	5.6	60	4.5
Mean age at BMI assessment in years (SD)	4364	6.2 (0.5)	1327	6.1 (0.5)
Bullying involvement				
Uninvolved	2846	65.2	872	65.7
Victim	193	4.4	193	14.5
Bully	715	16.4	162	12.2
Bully-victim	610	14.0	100	7.5
Mean age at bullying assessment in years (SD)	3757	6.8 (1.3)	1327	7.7 (0.8)
Maternal and family characteristics				
Educational level				
Primary or secondary	1734	47.4	411	36.2
Higher vocational	958	26.2	353	31.0
Academic	967	26.4	372	32.8
Single parenthood (% yes)	550	15.0	170	14.8
Presence of siblings (% no)	677	20.0	218	19.4

^aChild reports represent self-reported victimization and peer-reported bullying.

^bSome data were missing for national origin (n=123), age at bullying assessment (n=607), maternal educational level (n=705), single parenthood (n=689), presence of siblings (n=797).

RESULTS

Our sample included 50.6% boys, 54.5% children of Dutch national origin and 19.2% overweight/obese children (Table 1). According to the teachers, 4.4% of children were a victim of bullying, 16.4% a bully, and 14.0% a bully-victim.

Association of child weight with victimization and bullying scores

Table 2 shows the association of BMI with continuous victimization and bullying scores based on teacher and child reports. A small, though statistically significant relationship between BMI and teacher-reported victimization was found: a one point increase in BMI was associated with a 0.05 increase on the standardized victimization score (95%CI: 0.03;0.07, p-value<0.001). Child reports were concurring, although the BMI–victimization relationship attenuated to statistical non-significance after accounting for confounders.

Next, we examined the relation between BMI and bullying perpetration scores. Again, similar results were found for teacher and child reports with a high BMI predicting more bullying. The associations were partly (up to 40%) explained by confounding factors, but remained statistically significant in the adjusted analyses.

Table 2. Children's BMI and victimization and bullying scores in early primary school

BMI	B (95% CI) for victimization SD-scores			
	Teacher report (N=4364)		Child report (N=1327) ^a	
	Unadjusted	Adjusted ^b	Unadjusted	Adjusted ^b
Per unit increase	0.06 (0.04; 0.08) ***	0.05 (0.03; 0.07) ***	0.05 (0.02; 0.08) **	0.03 (-0.004; 0.06)
	B (95% CI) for bullying SD-scores			
Per unit increase	0.05 (0.03; 0.07) ***	0.03 (0.01; 0.05) **	0.08 (0.05; 0.11) ***	0.05 (0.02; 0.07) **

^a Child reports represent self-reported victimization and peer-reported bullying.

^b Adjusted for child gender, age and national origin, maternal education, single parenthood, and presence of siblings in the family.

* p-value <0.05, ** <0.01, ***<0.001.

Gender interactions and physical bullying

The teacher-reported bullying perpetration score was predicted by an interaction between BMI and gender (p-value=0.026). Analyses stratified by gender indicated that BMI was positively associated with bullying among boys (B=0.05, 95%CI: 0.02;0.09, p-value=0.002), but not in girls (B=0.02, 95%CI: -0.01;0.01, p-value=0.095).

Next, we analyzed physical, verbal, relational and material bullying separately. A higher BMI predicted higher levels of physical, verbal and relational bullying and victimization, but not material bullying and victimization. A significant gender interaction was found for physical bullying. Analyses stratified by gender indicated that a higher BMI was associated with rel-

atively high levels of physical bullying among boys ($B=0.02$, 95%CI: 0.01;0.04, p -value=0.005), but not in girls ($B=0.01$, 95%CI: -0.001;0.02, p -value=0.054).

Association of child weight with different bullying involvement roles

Next, we examined whether weight status predicted bullying involvement roles. We compared the non-overlapping groups of uninvolved children, victims, bullies and bully-victims (Table 3). Obese children had a higher risk than normal weight children to be a bully-victim according to teacher reports (aOR=2.25, 95%CI: 1.62;3.14). A similar result was found for the child reports of bullying, although the effect was attenuated in the adjusted analyses (OR=2.37, 95%CI: 1.03;5.44; aOR=1.92, 95%: 0.75;4.93). Overweight and obesity were not associated with risk of being solely a victim or solely a bully.

Table 3. Children's weight status and bullying involvement in early primary school

	Bullying involvement roles							
	Uninvolved		Victim		Bully		Bully-victim	
	n	aOR (95% CI) ^a	n	aOR (95% CI) ^a	n	aOR (95% CI) ^a	n	aOR (95% CI) ^a
Weight status	Teacher report (N=4364)							
Normal weight	2332	Reference	151	Reference	592	Reference	451	Reference
Overweight	383	Reference	28	1.00 (0.65; 1.52)	93	0.86 (0.68; 1.00)	91	1.14 (0.89; 1.46)
Obesity	131	Reference	14	1.35 (0.76; 2.39)	30	0.72 (0.48; 1.10)	68	2.25 (1.62; 3.14) ***
Weight status	Child report (N=1327)							
Normal weight	735	Reference	155	Reference	136	Reference	80	Reference
Overweight	106	Reference	26	0.86 (0.68; 1.00)	17	1.10 (0.69; 1.74)	12	0.81 (0.48; 1.36)
Obesity	31	Reference	12	0.72 (0.48; 1.10)	9	1.68 (0.85; 3.30)	8	1.33 (0.59; 3.01)

^a Adjusted for child gender, age and national origin, maternal education, single parenthood, and presence of siblings in the family.

*** p -value <0.001.

Sensitivity analyses

Analyses presented in Table 2 were repeated in 1102 children for whom teacher *and* child reports were available, resulting in a rather similar picture as in the full sample (Supplementary Table 2). Effect estimates for the associations did not differ between teacher and child reports (victimization: p -value=0.26; bullying: p -value=0.52). Combining the reports in multivariate analyses showed that a higher BMI was associated with more victimization ($B=0.02$, 95% CI: 0.001; 0.05, p -value=0.041) and more bullying ($B=0.04$, 95% CI: 0.01;0.06, p -value=0.004).

DISCUSSION

Using a multi-informant approach relying on teacher and child-reports of bullying, this large population-based study showed that already in early primary school, a higher BMI was associated with more bullying involvement. Although a graded relation was visible across the whole BMI spectrum, particularly obese children were often involved in bullying behavior. Additional analyses revealed that obese children are not solely a victim or a bully, but rather very likely to be a bully-victim.

Our finding that a high BMI and victimization at school entry are related is important as it suggests that children perceive their peers with overweight/obesity as attainable targets of bullying at a younger age than previously shown.⁹⁻¹⁶ Importantly, we relied on objectively measured BMI and multiple informants to assess bullying involvement. Results for teacher and child reports were consistent, suggesting that earlier research using self-reported data on both BMI and victimization were not biased but likely reflect true findings.^{9-12,14-16} Stigma against adiposity may explain the high rates of victimization among obese children, but it is also plausible that children with overweight have a relatively low self-esteem which makes them an easy target for peer bullying.

In line with previous research,^{11,12} we found that a high BMI predisposes boys, but not girls to bullying perpetration. This gender difference was due to heavier boys being particularly likely to participate in *physical* bullying, which provides support for the hypothesis that heavy-set boys may use their physical strength to bully others.^{11,12} Young girls with overweight/obesity do not seem tempted to use physical strength to obtain dominance or popularity in the peer group, probably because in general, girls participate more in indirect, relational forms of bullying, like gossiping and excluding.¹⁹

By assessing both victimization and bullying perpetration, we were able to examine different bullying involvement roles. Results indicated that obese children are more likely to be bully-victims rather than victims or bullies only. This is in line with findings of a Canadian study reporting a large, albeit non-significant risk of overweight children to be bully-victims.¹² Several mechanisms may explain the association. The most intuitive explanation is the use of reactive aggression of obese children as a response to being victimized. This reasoning is supported by our recent work providing evidence that overweight/obesity is a cause, rather than a consequence of peer problems (e.g. having no friends).²⁸ Obesity and bullying involvement may also have a common underlying cause. Poor regulation of emotions could lead to maladaptive, awkward behavior towards peers, but also to abnormal eating behaviors (e.g. overeating) as a coping strategy. Likewise, bully-victims tend to have behavioral characteristics of attention deficit-hyperactivity disorder, such as violating social norms by interrupting conversations and having difficulty taking turns appropriately.⁵ These behaviors may predispose them to bullying involvement, while impulsivity and inhibition problems have also been linked to overeating and overweight.²⁹

Contrary to our hypothesis, children with overweight had rather similar risks of bullying involvement as their normal weight counterparts. This has been observed previously in studies in secondary school and higher grades of primary school.^{11-13,16} Considering that differences in physical appearance can lead to victimization, these findings suggest that overweight may be perceived by children as a normal characteristic rather than a deviation, probably due to its high prevalence.¹⁸

A further important addition to existing literature is the importance of possible confounding factors. Previous studies presented marginally adjusted results,^{10-12,14-16} while sociodemographic factors like socioeconomic and ethnic background are important risk factors for overweight^{30,31} and have also been implicated in bullying involvement^{19,32}, although not consistently.³³ We showed that these factors accounted for a substantial part of the BMI – bullying association. These covariates may mirror shared etiological factors: a recent meta-analysis, for instance, indicated that maladaptive, negative parenting is a predictor of bullying involvement,³⁴ while these parenting practices are also more common among disadvantaged families.³⁵

The current study is strengthened by its population-based sample of young primary school children, the availability of measured BMI and multiple informants on bullying behavior, including both teachers and children. Future studies may consider also including parents as informants for an even more comprehensive picture. Limitations of this study include the cross-sectional nature of the analyses that preclude inferences on causality. Although it is likely that overweight triggers peer victimization, the direction of the association may also be reversed. Another limitation is that the extensive peer assessment of bullying was available only in a subsample of 1327 children in the Generation R cohort. Consequently, some analyses may have been underpowered, as rather high effect estimates were not always statistically significant – a tendency also observed in the complete case analysis ($n=1102$).

In sum, we argue that the period around entry to primary school is an important developmental phase during which obese children are at risk of bullying involvement. Importantly, obese children are likely to be bully-victims, rather than solely victims or bullies. Further research is needed to unravel the factors contributing to the risk of obese children to be a bully-victim and to elucidate whether obesity and bullying involvement are causally related or have a common underlying cause. Meanwhile, close monitoring of social well-being among children with obesity is advised. It should be evaluated whether young obese children benefit from skills training to improve coping with stigma and negative peer interactions. Finally, bullying involvement among overweight and obese children may be targeted in an anti-bullying program.³⁶ Typically, such interventions start in the higher grades of primary school,³⁷ while our findings support the importance of bullying prevention early in the school curriculum. Timely implementation may prevent overweight and obese children to become entrapped in a downward spiral in which their weight problems worsen due to peer problems.

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SUPPLEMENTARY MATERIAL

Supplementary Table 1. Children's BMI and victimization and bullying scores in early primary school in subsample of 1102 children with both teacher and child report available

		Adjusted B (95% CI) for victimization SD-score^a		
BMI	Teacher report	Child report ^b	Comparison of effect estimates, p-value	Overall estimate (teacher and child report combined) ^c
Per unit increase	0.03 (0.00; 0.06)	0.02 (-0.02; 0.05)	0.26	0.02 (0.001; 0.05) *
		Adjusted B (95% CI) for bullying SD-score^a		
Per unit increase	0.02 (-0.02; 0.06)	0.05 (0.02; 0.08) **	0.52	0.04 (0.01, 0.06) *

^a Adjusted for child gender, age and national origin, maternal education, single parenthood, and presence of siblings in the family.

^b Child reports represent self-reported victimization and peer-reported bullying.

^c Derived from a Generalized Estimating Equation analyses combining teacher and child reports.

* p-value <0.05, ** <0.01, ***<0.001.

Chapter 8

Television viewing and externalizing problems in preschool children: The Generation R Study

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ABSTRACT

Objective: To determine whether the amount, type, and patterns of television viewing predict the onset or the persistence of externalizing problems in preschool children.

Design: Longitudinal study of a prospective population-based cohort in the Netherlands.

Setting: Parents reported time of television exposure and type of programs watched by children. Externalizing problems were assessed using the Child Behavior Checklist at 18 and 36 months.

Participants: A population-based sample of 3913 children.

Main exposure: Television viewing time, content and patterns of exposure (at 24 and 36 months) in children with and without pre-existing problems to assess the incidence and persistence of externalizing problems.

Outcome measure: Externalizing problems at 36 months.

Results: Program content and time of television exposure assessed at 24 months did not predict the incidence of externalizing problems at 36 months (odds ratio=2.24; 95% confidence interval, 0.97–5.18). However, the patterns of exposure over time reflecting high levels of television viewing were associated with the incidence of externalizing problems (odds ratio=2.00; 95% confidence interval, 1.07– 3.75), and the persistence of the preexisting externalizing problems (odds ratio=2.59; 95% confidence interval, 1.03–6.55).

Conclusions: Our study showed that high television exposure increases the risk of the incidence and the persistence of externalizing problems in preschool children.

INTRODUCTION

According to the recently updated guidelines of the American Academy of Pediatrics (AAP)¹ media exposure at a young age should be discouraged because it may have negative consequences for health and development of children. It has been reported that 17-48% of children at the age of 3 years or younger do not comply with these recommendation.² A study of media consumption in the US has demonstrated that 73% of preschool children watch television (TV) on a daily basis, spending approximately 2 hours a day in front of TV.³ Increased media exposure time among young children,⁴⁻⁵ a shift toward younger age,^{2-3,6} and exposure to adult content⁶ reflect importance of this public health problem.

Exposure to media encompasses both viewing time and content of the media.⁷⁻¹⁰ Several studies showed positive effects of educational content on a number of developmental outcomes.^{7,11-12} However, there is also evidence suggesting an association between exposure time and behavioral outcomes regardless of the content.¹³⁻¹⁴ Negative effects of excessive television viewing and its content were reported in particular for aggressive behavior^{13,15-20} and attention problems.^{5,15-17} However, these studies were conducted mostly in school-aged children and adolescents, whereas aggressive behavior and attention problems, which are well-known risk factors for a number of disorders, are already prevalent in early childhood.¹⁸ Poor attention ability and aggression in children are referred to as “externalizing problems”. The term also refers to such behaviors as noncompliance, hyperactivity, and concentration difficulties.^{18-19,20}

Currently, despite the high prevalence of TV viewing among preschool children, little is known about the effects of television exposure on subsequent externalizing problems. Several high-quality studies examined the prevalence of media exposure²¹ and its associations with cognitive development,²² hyperactivity-inattention and prosocial behavior.²³⁻²⁴ Most studies of externalizing problems in preschool children,^{13,25-26} however, have limitations, such as relatively small and high-risk samples,²⁵ and cross-sectional data,^{13,26} which cannot establish temporality of the observed association. Furthermore, earlier studies did not address content of television programs watched by young children²³ and did not adjust for parental psychosocial risk factors.^{13,23}

Using prospective data from a large population-based cohort in the Netherlands, we addressed the following questions: a) is the duration and content of television exposure at 24 months associated with externalizing problems at 36 months; and b) what is the effect of the patterns of television exposure between 24 and 36 months on incident and persistent externalizing problems at 36 months?

Compared with earlier similar research²⁷ we examined behavioral outcomes among children at a younger age and accounted for the pre-existing problems to examine the persistence of problem behavior. Whereas most of the previous studies were conducted in the US

with high levels of TV viewing, we examine the effects of TV viewing on externalizing problems among children in Europe.

METHODS

Design and study participants

This study was performed within the Generation R Study, a large population-based cohort in Rotterdam, the Netherlands. The cohort has been described in details elsewhere.²⁸ The Generation R Study was approved by the Medical Ethics Committee of the Erasmus University Medical Center.

Pregnant women living in Rotterdam (delivery date of April 1, 2002 through January 31, 2006) were invited to participate. Full consent for study participation was obtained from 7295 mothers. All participants provided written informed consent. Data on children's TV exposure at 24 and 36 months were available for 4368 children. For 3913 of these children, information on externalizing problems at 18 and 36 months was available. Analyses of these 3913 children were performed in two strata: children without pre-existing externalizing problems (N=3437) and children with externalizing problems present at 18 months (N=476). However, analyses of repeated measure of TV exposure patterns were performed in 3761 children (strata of 3309 and 452).

Measures

TV exposure

Parental questionnaires at 24 and 36 months contained questions on television exposure of children. In a similar study using a continuous measure to assess television viewing at 2.5 and 5.5 years exposure was categorized as >2 hours of daily television viewing.²⁷ We used a similar categorization but the maximum duration of TV viewing at 24 months was adapted to >1 hour accounting for the younger age. Therefore, duration of *daily television viewing* was assessed using the following answer categories: "never", "<0.5 hour", "0.5-1 hour" and ">1 hour" a day. Categories at 36 months were adapted (categories "1-2 hours" and ">2 hours" were added) to differentiate at the high ranges in older children.

At 24 months parents also reported whether their child watched TV programs suitable or unsuitable for children. In the Netherlands television is state regulated and is organized by channels, which have content appropriate for children (e.g. cartoons, educational programs). Parents reported channels and programs their children watched, and whether their children watched programs for adults or age-inappropriate programs (a category "unsuitable for children TV programs"). Programs shown on the channels for children were categorized as "suitable for children TV programs".

On the basis of TV exposure at 24 and 36 months we created a variable reflecting the patterns of daily exposure over time: “*never or <0.5 hour*” (<0.5 h/d at 24 and 36 months) N=789, “*continued low TV exposure*” (0.5–1 h/d at both ages) N=974, “*continued moderate TV exposure*” (1 hour at both ages) N=681, “*high exposure*” (reflecting an increase in exposure and continued high exposure) N=1317. The size of the latter group allowed more specific exposure definitions: “*increased TV exposure time*” (increased from <0.5 h/d at 24 months to ≥ 1 h/d at 36 months) N=276, and “*continued high TV exposure*” (≥ 0.5 h/d at 24 months and ≥ 1 h/d at 36 months) N=1041. The two categories reflecting decreasing exposure were too infrequent for meaningful analyses (total N=152 for two exposure categories over two strata), therefore these categories were not used in further analyses. Consequently, the analyses of the patterns of television exposure were performed in 3761 of 3913 children (strata 3309 and 452).

Externalizing problems

The Dutch version of the Child Behavior Checklist (for children aged 1½–5 years)^{19,29} was used to obtain parent reports on children’s behavioral problems in the preceding two months at 18 and 36 months on a 3-point Likert scale. The externalizing scale consists of two subscales: attention problems (5 items) and aggressive problems (19 items). Examples of items assessing attention and aggression problems are: ‘*Can’t sit still, restless, or hyperactive*’ and ‘*Hits others*’, respectively. Because the distribution of the continuous variable was skewed and could not be transformed to satisfy the assumption of normality, a dichotomous variable was used. We applied a cut-off point based on Dutch norms.²⁹ The subscale score equivalent to the Dutch norm (83rd percentile) for externalizing problems was a score of 18, which in our sample corresponded to the 88th percentile. The Child Behavior Checklist (for children aged 1½–5 years) has good reliability and validity.^{19,29}

Covariates

Confounders were considered on the basis of previous studies of television exposure.^{2,5,8,17,21,27,30} Child sex, age, national origin, day care attendance, maternal and paternal age, educational level, marital status, monthly income, maternal symptoms of psychiatric disorders, parenting stress, and parity were assessed by questionnaires. *National origin of a child* was defined by country of birth of the parent(s) and categorized as *Dutch*, *Other Western* or *Nonwestern*.³¹ The highest attained *educational level* of the parents (4 categories) ranged from “*low*” (<3 years of general secondary education) to “*high*” (higher academic education or PhD).³² The net monthly household *income* comprised the categories: “<1200 euro” (approximately US \$1500), “1200–2000 euro” (approximately US \$1500–2500), “>2000 euro” (approximately US \$2500).

The Brief Symptom Inventory, a validated instrument containing 53 self-appraisal statements,³³ was used to assess general symptoms of maternal psychiatric disorders when children were 2 months old. Parenting stress was assessed by the Nijmeegse Ouderlijke Stress Index – Kort,³⁴ a questionnaire consisting of 25 items on parenting stress related to parent

and child factors. Weighted sum scores were used in the analyses. Day care attendance was categorized as “<16 hours per week” and “≥16 hours per week” (modal value).

Statistical analysis

Analyses were performed in two different strata of children. A stratum without behavioral problems at 18 months was analyzed (N=3309), allowing us to identify incident behavioral problems at 36 months. The second stratum (N=452) consisted of children who had developed externalizing problems by 18 months (i.e. some months before television viewing was assessed). This enabled us to determine the influence of TV exposure on persistence of behavioral problems.

First, we examined whether TV exposure time at the age of 24 months and exposure to specific content predicted behavioral problems at the age of 36 months, using logistic regression analyses. Three models were examined: (1) univariate; (2) adjusted for externalizing symptoms score at the age of 18 months using the continuous measure; (3) additionally controlled for socioeconomic and psychosocial covariates. Next, we examined whether patterns of television exposure from 24 to 36 months were associated with incident or persistent externalizing problems at 36 months using the same set of models.

The externalizing problems score at 36 months had a skewed distribution, was dichotomized and analyzed with logistic regression. To control for the degree of externalizing problems at baseline, a continuous measure of externalizing problems at 18 months was used because logistic regression does not require the assumption of normality. The dichotomous measure of externalizing problems at 18 months was used to define the pre-existing externalizing problems for the stratified analyses.

Missing data on covariates were estimated using multiple imputation techniques (SPSS, version 17). All covariates were used to estimate missing values. The reported effect estimates are the pooled results of 30 imputed datasets.

Nonresponse analyses

Children with missing data on behavioral problems at 18 months and TV exposure time at 24 months were compared with those without missing information on these variables. Data were missing more often in children of non-Dutch national origin (45.8% vs. 12.4%, $p<0.001$). Mothers of children with missing data also were less educated (47.6% vs. 23.8%, $p<0.001$), younger (mean difference 1.4 years, $p<0.001$), and more often single (26.4% vs. 15.6%, $p<0.001$) and had lower income level (33.4% vs. 32.1%, $p<0.001$) than mothers without missing data.

RESULTS

There were more boys (56.3% vs. 48.4%, $p<0.001$) and more children of non-Dutch national origin (38.5% vs. 28.1%, $p<0.001$) among children who had externalizing problems at 18 months (Table 1).

Table 1. Child and parental characteristics and externalizing behavioral problems at 18 months

	No. of individuals (N= 3913)	Externalizing problems at 18 months		<i>p</i> value ^a
		Yes	No	
		N=476	N=3437	
Child characteristics				
Male sex, %	3913	56.3	48.4	<.001
National origin	3864			<.001
Dutch	2732	61.5	72.0	
Other Western	369	10.3	9.5	
Non-Western	763	28.2	18.6	
Parental characteristics				
Age mother, mean (SD), y	3913	30.9 (4.9)	31.9 (4.3)	<.001
Age partner, mean (SD), y	2966	33.3 (5.0)	33.9 (4.9)	.02
Maternal educational level, %	3804			<.001
Low	466	19.4	11.3	
Mid-low	999	28.1	26.0	
Mid-high	995	25.7	26.2	
High	1344	26.8	36.5	
Paternal educational level, %	2759			.01
Low	379	15.5	13.5	
Mid-low	669	30.4	23.5	
Mid-high	607	21.4	22.1	
High	1104	32.7	40.9	
Income, € (approximately US\$)	3320			<.001
<1200 (<1500)	261	13.5	7.1	
1200-2000 (1500-2500)	491	16.0	14.6	
>2000 (>2500)	2568	70.5	78.3	
Maternal marital status, % single	3779	13.7	6.0	<.001
Maternal symptoms of psychiatric disorders, ^b mean (SD)	3129	0.36 (0.4)	0.19 (0.3)	<.001
Parenting stress, ^c mean (SD)	3883	0.51 (0.39)	0.26 (0.26)	<.001
Day care attendance	2581			.34
<16 h	1265	32.9	36.9	
≥16 h	1316	39.4	37.7	
Parity, %	3798			.18
0	2253	61.9	59.0	
1	1144	30.1	30.1	
≥2	401	8.2	10.9	
TV exposure at 24 months, %	3913			.004

Table 1. Child and parental characteristics and externalizing behavioral problems at 18 months (*continued*)

	Externalizing problems at 18 months			
	No. of individuals (N= 3913)	Yes	No	p value ^a
		N=476	N=3437	
Never	284	6.9	7.3	
<0.5 h/d	1600	34.0	41.8	
0.5-1 h/d	1443	40.1	36.4	
>1 h/d	586	18.9	14.4	
TV exposure at 36 months, h/d	3913			.001
Never or <0.5 h/d	972	18.1	25.8	
0.5-1 h/d	1624	41.8	41.5	
1-2 h/d	1050	31.5	26.2	
>2 h/d	267	8.6	6.6	
Content of the TV programs, %	3832			.06
Not watching TV	284	7.1	7.5	
Watching age-appropriate TV	3320	84.5	86.9	
Watching unsuitable programs	228	8.4	5.6	

Abbreviation: TV, Television

^a P-values indicate statistically significant differences between children with and without behavioral problems. The values are derived from χ^2 -tests (categorical variables), and ANOVA tests (continuous variables).

^b Symptoms of psychiatric disorders were measured with the Brief Symptom Inventory.

^c Parenting stress was measured by Nijmeegse Ouderlijke Stress Index – Kort when children were 18 months old.

Mothers of children who had externalizing problems were slightly younger (30.9 vs. 31.9 years), had lower educational levels (47.5% vs. 37.3%), lower household income (29.5% vs. 21.7%), were more often single (13.7% vs. 6.0%) and had higher scores for symptoms of psychiatric disorders (0.36 vs. 0.19).

Incidence of externalizing problems

We examined the effects of TV exposure time and content at 24 months on the incidence of externalizing problems. Exposure time of more than 1 h/d did not predict the incidence of externalizing problems at 36 months (odds ratio [OR] =2.24; 95% confidence interval [CI], 0.97–5.18). The association was weaker once adjusted for socioeconomic and psychosocial covariates (OR=1.53; 95% CI, 0.62–3.81). Also, watching unsuitable television programs at 24 months was not related to the incidence of externalizing problems at 36 months (OR=2.56; 95% CI, 0.95–6.88).

Next, we examined the association of children's patterns of television exposure over time with the incidence of externalizing problems (Table 2). The overall *high TV exposure* was associated with incident externalizing problems (OR=2.62; 95% CI, 1.48–4.66) and remained statistically significant after controlling for any preexisting externalizing symptoms and socioeconomic and psychosocial covariates (OR=2.00; 95% CI, 1.07–3.75). *Continued high exposure*,

Table 2. Incident externalizing problems by television watching patterns

	No. of individuals	Model					
		Univariate analysis		Adjusted for externalizing problems at 18 months ^b		Additionally adjusted for socioeconomic and psychosocial covariates ^c	
Patterns of TV exposure over time	(N=3309) ^a	OR (95% CI)	<i>p</i> value	OR (95% CI)	<i>p</i> value	OR (95% CI)	<i>p</i> value
Never or <0.5h/d	726	1 [Reference]		1 [Reference]		1 [Reference]	
Continued low TV exposure	857	1.13 (0.58-2.23)	0.72	1.06 (0.53-2.12)	0.86	1.01 (0.55-2.57)	0.98
Continued moderate TV exposure	600	1.47 (0.73-2.93)	0.28	1.20 (0.59-2.44)	0.61	1.20 (0.57-2.50)	0.63
High TV exposure:		2.62 (1.48-4.66)	0.001	2.21 (1.23-3.97)	0.008	2.00 (1.07-3.75)	0.03
Continued high exposure	886	2.66 (1.47-4.79)	0.001	2.30 (1.26-4.21)	0.007	2.09 (1.08-4.01)	0.03
Increased exposure time	240	2.50 (1.15-5.41)	0.02	1.90 (0.86-4.21)	0.11	1.78 (0.78-4.05)	0.17

Abbreviations: OR, odds ratio; TV, television.

^a Children with externalizing problems at 18 months (n=452) were excluded from the analyses.

^b Externalizing problems at 18 months as continuous measure.

^c Externalizing problems at 18 months as continuous measure plus child's age, national origin and sex, day-care attendance, maternal and paternal age, maternal and paternal educational level, marital status, monthly income, maternal symptoms of psychiatric disorders, parenting stress, and parity.

a subgroup of children with high TV exposure, predicted incidence of externalizing problems also after full adjustment of the association (OR=2.09; 95% CI, 1.08–4.01). The effect of the *increased exposure time* over time on the incidence (OR: 2.50, 95% CI: 1.15–5.41) attenuated once adjusted for externalizing symptoms at 18 months (OR=1.90; 95% CI, 0.86–4.21).

Persistence of externalizing problems

We examined the effect of the patterns of TV exposure on the persistence of externalizing problems at 36 months in children who already had behavioral problems at the age of 18 months (Table 3). The variable reflecting overall *high TV exposure* predicted the likelihood of the persistent externalizing problems (OR=3.24, 95% CI, 1.39–7.54) also after full adjustment for the confounders (OR=2.59; 95% CI, 1.03–6.55). Again, we performed additional analyses in the subgroups. Adjusting the association between *continued high exposure* and persistent externalizing problems for pre-existing externalizing symptoms and psychosocial covariates rendered it non-significant (OR=2.13; CI, 0.82–5.51). Although few children had an increase in exposure between 24 and 36 months, the effect of increased television viewing on persistence of externalizing problems was strong in children with pre-existing problems (OR=5.99; 95% CI, 1.86–19.30).

Post-hoc analyses of television exposure patterns were performed for Aggression and Attention subscales. The obtained point estimates were in line with those for externalizing

Table 3. Persistent externalizing problems by television exposure over time

	No. of individuals	Model					
		Univariate analysis		Adjusted for externalizing problems at 18 months ^b		Additionally adjusted for socioeconomic and psychosocial covariates ^c	
Patterns of TV exposure over time	(N=452) ^a	OR (95% CI)	<i>p</i> value	OR (95% CI)	<i>p</i> value	OR (95% CI)	<i>p</i> value
Never or <0.5h/d	63	1 [Reference]		1 [Reference]		1 [Reference]	
Continued low TV exposure	117	1.85 (0.74-4.61)	0.19	1.52 (0.59-3.91)	0.38	1.28 (0.48-3.47)	0.62
Continued moderate TV exposure	81	1.97 (0.76-5.13)	0.17	1.62 (0.60-4.33)	0.34	1.43 (0.50-4.09)	0.50
High TV exposure:		3.24 (1.39-7.54)	0.007	3.01 (1.27-7.14)	0.01	2.59 (1.03-6.55)	0.04
Continued high exposure	155	2.78 (1.17-6.60)	0.02	2.53 (1.05-6.14)	0.04	2.13 (0.82-5.51)	0.12
Increased exposure time	36	5.71 (2.05-15.97)	0.001	5.75 (1.99-16.60)	0.001	5.99 (1.86-19.30)	0.003

Abbreviations: OR, odds ratio; TV, television.

^aThese analyses were performed on a subsample of children who had externalizing problems at 18 months (n=452).

^bExternalizing problems at 18 months as continuous measure.

^cExternalizing problems at 18 months as continuous measure plus child's age, national origin and sex, day care attendance, maternal and paternal age, maternal and paternal educational level, marital status, monthly income, maternal symptoms of psychiatric disorders, parenting stress, and parity.

problems, although only the results for persistent attention problems reached statistical significance (see Supplementary Tables 1-3).

COMMENT

Children develop their TV viewing patterns early in childhood and these patterns are likely to be sustained.^{2,35} We found that young children's continued exposure to television increases their risk for incident externalizing problems, and children with the pre-existing externalizing problems are more likely to have persistent problems due to high (increasing) television exposure early in childhood.

Several theories offer an explanation for the influence of media on child development. Content-based theories emphasize the importance of the quality of programs. According to these theories children learn from the content by using cognitive and social learning mechanisms.⁹ However, studies regarding the learning effects of TV viewing are inconclusive and there is little evidence for beneficial outcomes in young children.¹ In our study the effect of content on development of externalizing problems was not statistically significant. However, the prevalence of exposure to an inappropriate content was low (8.4% in children with externalizing problems and 5.6% in those without) our sample may have been too small to detect

an effect. Also, the measure of content may not have been sensitive enough, or mothers may have been disinclined to report their children's exposure to inappropriate content.

According to the displacement theory⁹ time spent viewing TV replaces other intellectually and physically stimulating activities. Also, rapid pace, various visual and audio effects may be too difficult for a young child to process.⁹ Having to process images in rapid sequence with little time to reflect on the content may have negative effects on attention abilities. In our study high level of exposure time was a risk factor for the onset and persistence of externalizing behaviors.

Our longitudinal study demonstrated the importance of repeated assessments of television exposure and behavior. Sustained and excessive exposure posed a risk for development of behavioral problems in young children, and this conclusion is in line with earlier research on the topic.²⁷ Collecting data longitudinally already at such a young age and differentiating between incident and persistent cases helps to address the issue of reverse causality. It is, however, more difficult to infer causality in the relation with persistent externalizing problems. Children may watch television as a result of their pre-existing problems.³⁶⁻³⁷ Parents could be more inclined to allow TV viewing.³⁸ If children have behavioral problems, parents may be tempted to use television as a babysitter to keep their child occupied.²¹ Nevertheless, the effects of high levels of exposure found in our study were very consistent across incident and persistent externalizing problems.

Television exposure in this population was relatively low compared with the prevalence reported for children in the US.^{3,5,21} Only 34% of children exceeded 1 h/d of TV viewing at 36 months, and only 7% exceeded 2 h/d at 36 months. This difference in exposure could be related to the high number of working hours of the parents or the societal attitudes about TV viewing.

Large population-based cohort studies provide an opportunity to prospectively investigate the association between television viewing in early childhood and behavioral problems. Differentiating the effect of such exposure on incidence and persistence of behavioral problems helped in establishing the temporality of the association. Furthermore, all studied associations were adjusted for a large number of covariates.

The nonresponse analyses indicated possible selective non-response which could have biased our results. Another limitation of our study is the use of parent reported media exposure. Mothers could have underreported the TV exposure giving socially desired answers. Using objective and specific measures could have provided more extensive and more precise information on TV viewing behaviors among children. Several other studies have used diary methods that appear to be more accurate in measuring the exposure and its content.^{7,25,35,39} However, the mother's report is well correlated with the diary method.³⁹ Another limitation of our study is the use of a categorical rather than a continuous measure of the television time exposure. Nevertheless, previous epidemiologic studies of population-based samples have used similar categorical measures.^{23,40-41} Furthermore, other factors that may affect both TV

viewing and externalizing problems, such as exposure to aggression or abuse in real life,⁴²⁻⁴³ or temperament of a child⁴⁴⁻⁴⁵ were not addressed. Finally, distinguishing between foreground and background exposures can advance the understanding of the mechanisms through which television viewing affects child development.

In conclusion, preschool children are a major target audience of the television market in Western societies.^{13,46} Extensive exposure to media influences development, behavior and day-to-day activities of young children. We have demonstrated that high levels of television exposure increase the likelihood of externalizing problems in preschool children, even in those who did not have preexisting externalizing problems. Having considered the findings of this and previous studies,^{2,13,16-17,26-27,47-52} the most useful advice for parents of preschool children would be to follow the AAP guidelines^{1,53} and discourage young children's exposure to TV either as the main activity or as a background exposure. Perhaps in doing so not only will externalizing problems be reduced but also associated problems such as obesity⁵⁴⁻⁵⁷ and other negative outcomes^{30,58-60} may be prevented.

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SUPPLEMENTARY MATERIAL

Supplementary Table 1. Incident Aggressive Problems and Patterns of Television Viewing

Patterns of TV exposure over time	No. of Individuals (n=3639) ^a	Model					
		Univariate analysis		Adjusted for aggressive problems at 18 months ^b		Additionally adjusted for socioeconomic and psychosocial covariates ^c	
		OR (95% CI)	p value	OR (95% CI)	p value	OR (95% CI)	p value
Never or <0.5 h/d	778	1 [Reference]		1 [Reference]		1 [Reference]	
Continued low TV exposure	942	1.66 (0.62-4.44)	.31	1.47 (0.54-3.97)	.45	1.34 (0.48-3.74)	.57
Continued moderate TV exposure	653	1.39 (0.47-4.17)	.55	1.15 (0.38-3.49)	.80	1.04 (0.33-3.23)	.95
High TV exposure		3.55 (1.48-8.50)	.004	2.75 (1.13-6.66)	.03	2.30 (0.91-5.85)	.08
Continued high exposure	998	3.58 (1.47-8.71)	.005	2.63 (0.86-8.07)	.09	2.44 (0.77-7.74)	.13
Increased exposure time	268	3.45 (1.15-10.36)	.03	2.78 (1.12-6.86)	.03	2.26 (0.87-5.90)	.09

^aChildren with aggressive problems at 18 months were excluded from the analyses.

^bAggressive problems at 18 months as continuous measure.

^cAggressive problems at 18 months as continuous measure plus child's age, national origin and sex, day care attendance, maternal and paternal age, maternal and paternal educational level, marital status, income, maternal symptoms of psychiatric disorders, parenting stress, and parity.

Supplementary Table 2. Incident Attention Problems and Patterns of Television Viewing

Patterns of TV exposure over time	No. of Individuals (n=3382) ^a	Model					
		Univariate analysis		Adjusted for attention problems at 18 months ^b		Additionally adjusted for socioeconomic and psychosocial covariates ^c	
		OR (95% CI)	p value	OR (95% CI)	p value	OR (95% CI)	p value
Never or <0.5 h/d	724	1 [Reference]		1 [Reference]		1 [Reference]	
Continued low TV exposure	885	0.82 (0.41-1.64)	.57	0.72 (0.36-1.47)	.37	0.64 (0.31-1.32)	.23
Continued moderate TV exposure	618	1.03 (0.50-2.12)	.95	0.88 (0.42-1.83)	.74	0.80 (0.38-1.70)	.56
High TV exposure		1.92 (1.08-3.41)	.03	1.52 (0.85-2.73)	.16	1.27 (0.69-2.35)	.45
Continued high exposure	913	1.87 (1.03-3.39)	.04	1.48 (0.81-2.70)	.21	1.22 (0.64-2.32)	.54
Increased exposure time	242	2.11 (0.96-4.61)	.06	1.70 (0.77-3.75)	.19	1.43 (0.63-3.23)	.39

^aChildren with attention problems at 18 months were excluded from the analyses.

^bAttention problems at 18 months as continuous measure.

^cAttention problems at 18 months as continuous measure plus child's age, national origin and sex, daycare attendance, maternal and paternal age, maternal and paternal educational level, marital status, income, maternal symptoms of psychiatric disorders, parenting stress, and parity.

Supplementary Table 3. Persistent Attention Problems and Patterns of Television Viewing

	No. of Individuals (n=379) ^a	Model					
		Univariate analysis		Adjusted for attention problems at 18 months ^b		Additionally adjusted for socioeconomic and psychosocial covariates ^c	
Patterns of TV Exposure over time		OR (95% CI)	<i>p</i> value	OR (95% CI)	<i>p</i> value	OR (95% CI)	<i>p</i> value
Never or <0.5 h/d	65	1 [Reference]		1 [Reference]		1 [Reference]	
Continued low TV exposure	89	2.61 (0.81-8.41)	0.11	2.54 (0.76-8.54)	0.13	2.22 (0.59-8.38)	0.24
Continued moderate TV exposure	63	3.23 (0.97-10.74)	0.06	3.38 (0.97-11.74)	0.06	2.34 (0.59-9.26)	0.23
High TV exposure		5.17 (1.77-15.09)	0.003	5.43 (1.78-16.58)	0.003	4.58 (1.32-15.92)	0.02
Continued high exposure	128	4.47 (1.50-13.33)	0.007	4.63 (1.48-14.46)	0.008	3.67 (1.02-13.19)	0.05
Increased exposure time	34	8.32 (2.43-28.52)	0.001	9.10 (2.52-32.84)	0.001	9.06 (2.12-38.82)	0.003

^aThese analyses were performed on a subsample of children who had attention problems at 18 months.

^bAttention problems at 18 months as continuous measure.

^cAttention problems at 18 months as continuous measure plus child's age, national origin and sex, day care attendance, maternal and paternal age, maternal and paternal educational level, marital status, income, maternal symptoms of psychiatric disorders, parenting stress, and parity.

Chapter 9

Television viewing through ages 2-5 years and bullying involvement in early elementary school

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ABSTRACT

Background: High television exposure time at young age has been described as a potential risk factor for developing behavioral problems. However, less is known about the effects of preschool television on subsequent bullying involvement. We examined the association between television viewing time through ages 2-5 and bullying involvement in the first grades of elementary school. We hypothesized that high television exposure increases the risk of bullying involvement.

Method: TV viewing time was assessed repeatedly in early childhood using parental report. To combine these repeated assessments we used latent class analysis. Four exposure classes were identified and labeled "low", "mid-low", "mid-high" and "high". Bullying involvement was assessed by teacher questionnaire (n = 3423, mean age 6.8 years). Additionally, peer/self-report of bullying involvement was obtained using a peer nomination procedure (n = 1176, mean age 7.6 years). We examined child risk of being a bully, victim or a bully-victim (compared to being uninvolved in bullying).

Results: High television exposure class was associated with elevated risks of bullying and victimization. Also, in both teacher- and child-reported data, children in the high television exposure class were more likely to be a bully-victim (OR = 2.11, 95%CI: 1.42-3.13 and OR = 3.68, 95%CI: 1.75-7.74 respectively). However, all univariate effect estimates attenuated and were no longer statistically significant once adjusted for maternal and child covariates.

Conclusions: The association between television viewing time through ages 2-5 and bullying involvement in early elementary school is confounded by maternal and child socio-demographic characteristics.

BACKGROUND

Bullying is conventionally defined as intentional and continuous peer aggression, involving power imbalance between a victim and aggressor [1]. It is a common problem in early elementary school. About 20-30% of children are involved in bullying either as a bully, victim or a bully-victim (i.e. being involved in bullying as a bully and a victim) [2,3]. Bullying involvement is associated with diverse behavioral and emotional problems in children [4]. Thus, identifying potential risk factors that may predispose children to bullying involvement at young age is important for informing prevention strategies.

Several bullying involvement roles are typically defined, among which the roles of a victim, bully and a bully-victim are of primary interest as these children are directly involved in bullying and are most at risk of psychopathology. For instance, victims often have internalizing problems and show increased symptoms of anxiety, depression, low self-esteem and poor social skills [4]. The behavior of bullies is marked by externalizing problems and it resembles behavior of children with conduct problems [4]. Furthermore, bullies typically demonstrate high levels of proactive aggression [5]. Bully-victims usually show high levels of both proactive and reactive aggression [6], and have symptoms of both internalizing and externalizing problems [7]. Compared to bullies and victims, the bully-victims stand-out as a group of children with the highest risk of developing multiple psychopathologic behaviors [8], and they are most likely to remain involved in bullying for prolonged periods of time [9]. It should be noted, the association between internalizing/externalizing problems and bullying involvement is most likely reciprocal. Studies showed that internalizing problems contribute to victimization, while being victimized in the first grades of elementary school uniquely contributes to an increase in internalizing and externalizing problems [7,10]. Furthermore, bullying involvement also increases the risk of later psychiatric disorders: in a large cohort study it was shown that being victimized at age 8 year predicts psychiatric disorders, such as anxiety and antisocial personality, 10 to 15 years later [11].

Exposure to media violence is considered to be one of the factors associated with aggressive and violent behavior [12,13]. Since Bandura's classical studies [14] on child imitation of violent videos, various observational and experimental studies have provided an abundance of evidence for a relation between viewing violence in the media and high levels of aggressive behavior [13]. Besides linking young children's viewing of violence on TV to aggression [15,16], studies also show a relation between adolescents' violent video game play and aggressive behavior [17]. These findings can be explained by content-based theories that emphasize the importance of the content and quality of programs watched. Following the content-based approach, children learn from the observed content by using cognitive and social learning mechanisms, as was suggested by Bandura in the social learning theory of aggression [18]. Exposure to violent content on TV may influence children's cognitive scripts and information processing, which then may impact children's social problem solving and behavior. Children

who are exposed to interpersonal or media violence are likely to encode and store cognitive rules on how to behave in problematic social situations, and these cognitions may guide their behavior in conflict situations [12]. Furthermore, children who are frequently exposed to violent television programs may become desensitized to aggression what, in its turn, can lead to weaker negative affective responses to observing violence and to stronger acceptance of aggressive behavior [12,13,19].

Some studies demonstrated the negative effects of the *time* of TV exposure on behavior [20-22]. This is in line with the time displacement theory that suggests that young children who are exposed to TV or screen media for excessively long periods of time are spending less time on intellectually and physically stimulating activities, as well as on peer interactions that are essential for the development of social skills. If parents of young children do not facilitate children's engagement in extracurricular activities that stimulate children's cognitive, physical and social development, children are likely to develop a passive lifestyle with television viewing as a default strategy of spending their time [23]. Following this view, a possible consequence of *excessive* TV exposure time at young age could include poor social skills and problems with peers.

Relatively little is known about the effects of TV viewing time on bullying involvement, particularly in young children. Because television exposure has been related to aggression, one may speculate that high television exposure at preschool age may predispose children to involvement in school bullying. However, another plausible assumption could be that children who are involved in bullying are likely to watch more television due to deprived relations with their peers. Studying television exposure at preschool age, prior to bullying occurrence, can reveal important information about children's possible susceptibility to bullying involvement. Results of two earlier studies in young elementary school children suggested that duration of television exposure at young age can be a risk factor for bullying [24] and victimization [25]. In a longitudinal study of 1314 children in Canada [25], Pagani and colleagues found that child TV exposure at age 2.4 and 4.4 years predicted victimization by classmates at age 10 years. Also, TV exposure at age 4 years was associated with an elevated risk of bullying at age 6-11 years in a prospective study of 1266 children in the US [24]. However, the association between preschool television viewing and bullying involvement in early elementary school needs to be ascertained in other large population-based studies, using multiple assessments of exposure throughout early childhood and carefully examining the issue of potential confounding variables.

Furthermore, previous studies that examined the association between time of television viewing and bullying involvement in early elementary school, although they were well-conducted, had some limitations, e.g. they used either only teacher or maternal report to assess bullying [24,25]. Teachers and parents are not always aware of child bullying involvement, and in order to avoid this potential bias, information about child bullying involvement should be ideally based on reports of multiple informants. One of the measures of bullying involvement

used in our study is based on a peer nomination method, and is a combination of child self-report and ratings by multiple peers. Obtaining information on bullying involvement from teachers and from multiple peers strongly enhances its reliability.

Importantly, previous studies in young children did not examine the effects of television exposure on specific bullying involvement roles (i.e. victim, bully, bully-victim) [24,25], while these roles may be associated with different risk factors and outcomes [26,27]. Also, in the existing studies, television exposure was assessed only at one [24] or two [25] time points, while multiple measurements of child TV exposure at preschool age provide more comprehensive information. Unlike a single assessment, which generates information about the exposure at one particular point in time, repeated assessments capture the patterns of the exposure over time. Finally, the role of other underlying factors should be considered as a possible alternative explanatory mechanism. Several socio-demographic and psychosocial covariates that may confound the association between television viewing and consequent bullying problems were selected in our study based on previous studies of television exposure in young children [22,24,25]. Analyses were adjusted for: child age, gender, national origin, internalizing and externalizing problems, and daycare attendance; maternal age, parity, educational level, marital status, household income, symptoms of depression, and parenting stress. We considered these potential confounders as conceptually relevant and examined whether inclusion of these variables in a model resulted in a change of the effect estimate of television viewing on bullying involvement. Importantly, apart from child and maternal socio-demographic characteristics, we considered child behavioral and emotional problems as possible confounding factors of the association between television viewing and bullying, as studies show that early television exposure is associated with behavioral problems [28,29], and that children's internalizing and externalizing problems are associated with bullying involvement [7].

The objective of our study was to examine the association between television viewing time at ages 2-5 years and bullying involvement in grades 1-2 of elementary school. We aimed to extend research knowledge in this field by: using repeated assessments of TV exposure time at preschool age, examining different bullying involvement roles, and by accounting for possible confounding effects of child and maternal factors. Based on the findings from previous studies [24,25], we hypothesized that time of television exposure is associated with a higher risk of bullying and peer victimization. In addition to our main aim of studying the prospective association between the time of TV exposure and bullying involvement, we examined whether an exposure to violent content at age 5 years is associated with bullying involvement in early elementary school.

METHODS

Design and study participants

Our study was embedded in the Generation R Study, a large population-based cohort of children in Rotterdam, the Netherlands. An extensive description of the cohort and various assessments that were carried out among children and their parents can be found elsewhere [30,31]. All participants provided written informed consent and the study has been approved by the Medical Ethics Committee of the Erasmus University Medical Centre.

Data on television exposure (i.e. minimum two assessments) throughout ages 2-5 were available for 5389 Generation R children. At the time Generation R participants attended grades 1-2 of elementary school, teachers were asked to fill out a questionnaire that included questions about child bullying involvement at school. The data collection was restricted to Rotterdam city and suburbs, thus teachers filled out questionnaires only for children residing in Rotterdam and suburbs (see Figure 1 for the flowchart of the sampling procedure). Teacher report of bullying was available for 3423 out of 5389 children with data on television viewing. Additionally, an extensive assessment of peer relationships at school, involving child peer- and self-reports, was performed in a subsample of the Generation R Study participants and their classmates. Peer/self-reports of bullying involvement were available for 1176 children.

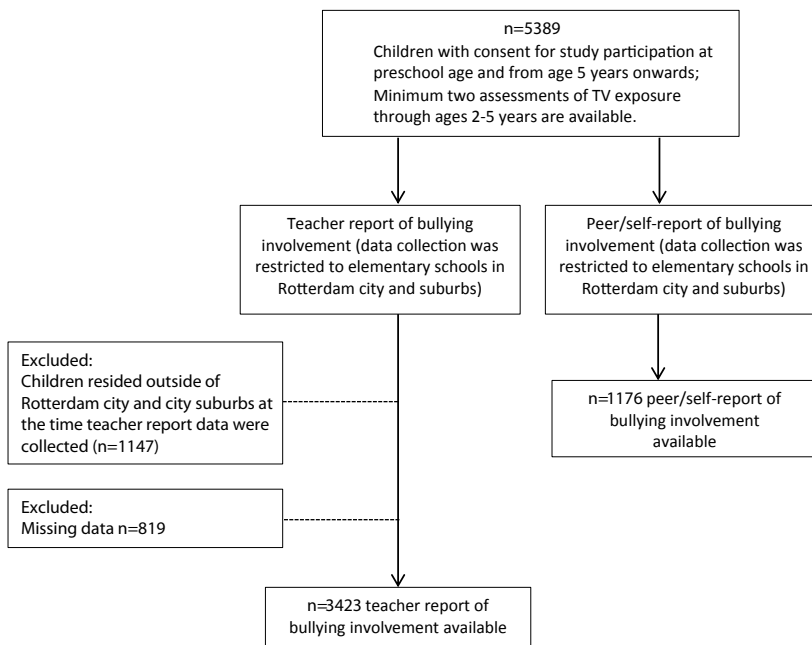


Figure 1. Flowchart of the sampling procedure.

The two data collection procedures, i.e. teacher and peer/self-reports of bullying involvement, were collected as part of different assessments, independently from one another. Consequently, the association between TV exposure through ages 2-5 and bullying involvement in early elementary school was studied in 3423 children using teacher report, and in 1176 children using peer/self-report of bullying involvement.

Measures

TV exposure

At the ages 2, 3, 4 and 5 years children's TV exposure time was assessed by parental questionnaires. At the youngest age, duration of *daily television viewing* was measured using the following answer categories: "never", "<0.5 hour", "0.5-1 hour" and ">1 hour". Categories of TV exposure time at the ages 3, 4 and 5 years were modified (maximum exposure category ">1 hour" was adapted to: "1-2 hours" and ">2 hours" of daily viewing) to better differentiate at the higher ranges of TV viewing in older children. The four TV exposure measures were combined into a latent variable that reflects child TV viewing patterns throughout ages 2-5 years (see statistics section for the description of the method).

Our main analyses are focused on examining the effects of the time of TV exposure. In addition, following the above reviewed work of Bandura and others, we also examined the effects of exposure to violent television content on children's bullying involvement. At the age of 5 years, parents of the children reported on whether their children were exposed to violent content on TV/video ("yes/no").

Bullying involvement

Teachers rated children's involvement in bullying (n = 3423, mean age 6.8 years) over past three months with regard to four types of bullying (physical, verbal, relational and material). To assess physical victimization teachers were asked: "Was a child victimized physically by other children, for instance by being hit, kicked, pinched, or bitten?". Verbal victimization was measured by: "Was a child victimized verbally, for instance by being teased, laughed at, or called names?". Relational victimization was assessed by: "Was a child excluded by other children?". Lastly, material victimization was studied by the question: "Were the belongings of a child hidden or broken by other children?". Bullying was measured using the same type of questions but then inquiring about a child's behavior as a bully. For example, to assess physical bullying teachers were asked: "Did a child physically bully other children, for instance by hitting, kicking, pinching, or biting them?". Items were rated on a four-point Likert scale with answer categories ranging from "Never or less than once per month" to "More than twice per week". Based on these ratings we categorized children into four mutually exclusive groups: "uninvolved in bullying", "bullies", "victims" and "bully-victims" [2]. Children, whose behavior with regards to all bullying and victimization items was rated with "Never or less than once per month", were categorized

as “*uninvolved in bullying*”. Children were categorized as “*victims*” if teachers reported them being victimized at least once a month in any of the four forms of victimization. Similarly, children were categorized as “*bullies*” when a teacher reported their involvement as a bully in any form of bullying at least once a month. Children rated by teachers as both bullies and victims were categorized as “*bully-victims*”.

Children completed a computerized assessment, the PEERS Measure ($n = 1176$, mean age 7.6 years), during which they independently reported about their experience of peer victimization. Detailed description of the method can be found elsewhere [32]. Again, four questions were used to assess different forms of victimization: physical, verbal, relational and material. We used the peer nomination method: children nominated their classmates by clicking on their photos on the screen, in order to indicate by whom they were victimized. The number of nominations a child gave to others was used to calculate individual victimization scores. The nominations a child received from classmates were used to calculate individual bullying scores. Considering that on average a school class consisted of 21 children, each child’s bullying score was based on the rating of about 20 peers. Therefore, the bullying score of each child reflects the extent to which a child is perceived as a bully by his/her classmates. Higher scores represent more bullying/victimization nominations. The individual bullying and victimization scores across different forms of bullying and victimization were averaged to obtain the overall bullying and victimization scores. In order to define specific roles of children’s involvement in bullying, we dichotomized the continuous bullying and victimization scores using the top 25th percentile as cut-off, which was applied also in earlier studies that used the peer nomination method [33]. The dichotomized measures were then used to categorize children into the non-overlapping groups: “*uninvolved in bullying*”, “*bullies*”, “*victims*” and “*bully-victims*”.

Covariates

Inclusion of the covariates resulted in a 5-10% change of the effect (inclusion of some resulted in a substantially larger change than 10%, e.g. maternal educational level, child ethnicity or household income). Although inclusion of few variables (namely, child age, gender, maternal depression symptoms, and parenting stress) led to a relatively small change of the effect estimates, all the variables were treated as potential confounders based on their conceptual relevance, and also, because in our data these covariates were associated with both children’s television exposure and with bullying involvement.

Information about child’s date of birth and gender was obtained from hospital registries. All other covariates were assessed using parental questionnaires. National origin of a child was defined by country of birth of the parent(s) and categorized as *Dutch*, *Other Western* or *Non-western*. Daycare attendance, assessed at age three year, was categorized as “*not attending daycare*” and “*attending daycare*”.

We also adjusted the analyses for child (pre-existing) internalizing and externalizing problems. Studies showed that these behavioral problems are associated with both televi-

sion viewing and bullying involvement: children with behavioral problems are likely to watch more television [34] and children involved in bullying often show internalizing and externalizing problems [7,4,33]. The Dutch version of the Child Behavior Checklist (CBCL1½-5) [35] was used to obtain parent reports of children's externalizing and internalizing behavioral problems at age 18 months. The 29-item externalizing scale of the CBCL consists of two subscales: Attention Problems and Aggressive Problems. The internalizing scale (36 items) consists of four syndrome scales: Emotionally Reactive, Anxious Depressed, Withdrawn and Somatic Complaints. The CBCL1½-5 has good reliability and validity [35].

Birth order (i.e. parity) was used to categorize children as "*first-born*" and "*not first-born*". The highest attained *educational level* of the mother (4 categories) ranged from "*low*" (<3 years of general secondary education) to "*high*" (higher academic education/PhD) [36]. Marital status was dichotomized into: "*married/living together*" and "*single*". The net monthly household *income* was categorized: "*below social security level*" (<1200 Euros), "*average*" (1200-2000 Euros) and "*modal*" (>2000 Euros). We used the Brief Symptom Inventory, a validated instrument containing 53 self-appraisal statements [37] to assess maternal symptoms of depression when children were 3 years old. Parenting stress was assessed when children were 18 months old, using the Nijmeegse Ouderlijke Stress Index-Kort [38], a questionnaire consisting of 25 items on parenting stress related to parent and child factors. For both measures, sum scores were used in the analyses.

Statistical analyses

In order to combine the information about children's TV exposures throughout ages 2, 3, 4 and 5 years, we used latent class analyses. A variable summarizing the pattern of TV exposure throughout preschool age carries more information than a single assessment at either of the different time points analyzed separately. Therefore, in the analyses we used a latent variable that combined information about child TV exposures at ages 2, 3, 4 and 5 years. However, we also studied the association using the separate TV exposure measurements at different ages to examine whether there is a specific vulnerable age at which viewing TV predisposes children to later bullying involvement; and to ensure the reliability of our findings irrespective of the method.

TV exposure patterns throughout ages 2-5 years were identified using latent class analyses performed in Mplus (version 6.12). With this technique, latent classes (i.e. groups) of children were generated based on their TV exposures at four different ages. The number of latent classes was determined by assessing the model fit indices: Bayesian Information Criteria (BIC) and the Lo-Mendel-Rubin Likelihood Ratio-Test (LMR-LRT; see Additional file 1: Table S1), along with other relevant characteristics such as the size of groups. The latent classes were derived from the data of all Generation R participants with at least two TV exposure assessments available throughout ages 2-5 years (N = 5389). The identified classes were then analyzed as predictors of bullying involvement at school.

Teacher- and peer/self-reported data on bullying were analyzed separately using multinomial regression models. We examined whether latent classes of TV watching throughout ages 2-5 predicted bullying involvement in early elementary school either as a bully, victim or a bully-victim (reference group: uninvolved). Two models were examined: (1) unadjusted and (2) adjusted for socio-demographic and psychosocial covariates. We also adjusted the analyses for separate groups of covariates in different models to examine if any observed association was confounded by a specific combination of child or maternal factors. Examination of the correlation coefficients for particularly strong correlations between the individual covariates (i.e. above .80) that could lead to collinearity problems during estimation of regression coefficients, showed no indication for concern. Additional collinearity diagnostic analyses – calculation of the variance inflation factor (VIF) values for the control variables – did not raise any further concerns (mean VIF = 1.42, VIF values for individual covariates ranged from 1.01 to 1.93; against the value of VIF > 10 indicating possible collinearity problems).

Missing data in the covariates were estimated using multiple imputation technique (chained equations). All covariates were used to estimate the missing values. The reported effect estimates are the pooled results of 30 imputed datasets. The imputed datasets were generated using STATA (Stata/SE 12.0, StataCorp LP Texas). In order to account for the clustered structure of the data (i.e. children from the same school classes were tested), we performed multinomial regression analyses using clustered robust standard errors (Huber-White method of variance estimation). School class was used as cluster variable.

Characteristics of the retained sample

Of all children with information on TV exposure, we compared those with ($n = 3423$) and without ($n = 1966$) teacher-reported data on bullying involvement. Data were missing more often for children of Dutch and other Western national origin than for children of non-Western origin. Children without a teacher report on bullying had somewhat higher levels of parent-reported externalizing problems (mean score 7.44, $SD = 6.61$ vs. 6.91, $SD = 6.08$, $p = 0.004$) and were more likely to be categorized as belonging to the low or mid-low TV exposure class. Mothers of children with missing data on bullying involvement were more often higher educated (37.0% vs. 47.7%, $p < 0.001$), and had a higher household income (9.5% vs. 12.0%, $p = 0.009$) compared to those for whom data on TV exposure was available.

RESULTS

Sample characteristics

Child and maternal characteristics of the study sample are presented in Table 1. Our sample comprised 50.6% boys and 63.1% children of Dutch national origin (Table 1). Based on teachers' ratings, 69.1% of children were categorized as uninvolved in bullying, 14.7% as bullies,

Table 1. Child and maternal characteristics

Child characteristics	Teacher report of bullying involvement (N = 3423)		Peer/self-report of bullying involvement (N = 1176)	
	N	% ^a	N	% ^a
Mean age (years, SD in months)	3143	6.8 (3.03)	1176	7.6 (8.95)
Gender (% boys)	3422	50.6	1176	49.1
National origin	3400		1171	
Dutch	2146	63.1	767	65.5
Other Western	316	9.3	131	11.2
Non-western	938	27.6	273	23.3
Bullying involvement	3423		1176	
Uninvolved	2366	69.1	705	60.0
Bully	502	14.7	176	15.0
Victim	139	4.1	179	15.2
Bully-victim	416	12.1	116	9.8
Internalizing problems ^b (mean score, SD)	2892	5.07 (4.64)	997	4.79 (4.21)
Externalizing problems ^b (mean score, SD)	2908	10.60 (6.69)	1001	10.35 (6.55)
Day-care attendance (% not attending)	2872	33.4	992	29.4
TV exposure classes	3423		1176	
Low	603	17.6	243	20.7
Mid-low	1448	42.3	520	44.2
Mid-high	951	27.8	292	24.8
High	421	12.3	121	10.3
Exposure to violent TV/video content at age 5 years	2999		1053	
No	1434	47.8	499	47.4
Yes	1565	52.2	554	52.6
Maternal characteristics				
Mean age (years, SD)	3422	31.40 (4.75)	1176	32.09 (4.78)
Educational level	3241		1113	
Low	569	17.6	143	12.9
Mid-low	978	30.2	327	29.4
Mid-high	747	23.1	287	25.8
High	947	29.2	356	32.0
Monthly household income	2740		980	
<1200 (below social security level)	329	12.0	110	11.2
1200-2000 (average)	490	17.9	167	17.0
>2000 (modal)	1921	70.1	703	71.7
Marital status (% single)	3217	8.7	1114	9.1
Depression symptoms ^c (mean score, SD)	2972	0.13 (0.32)	1025	0.13 (0.31)
Parenting stress (mean score, SD) ^d	2935	0.31 (0.30)	1007	0.32 (0.30)
Parity (% first-born)	3306	56.5	1134	56.2

^a Unless otherwise indicated.

^b Assessed with CBCL 1½-5, the Dutch version of Child Behaviour Checklist.

^c Measured with Brief Symptom Inventory.

^d Parenting stress was measured with the Nijmeegse Ouderlijke Stress Index–Kort.

4.1% as victims and 12.1% as bully-victims. Proportions of bullying involvement were slightly different in peer/self-reported data, with fewer children categorized as uninvolved (60.0%, p-value for comparison between teacher and peer/self-reports: <0.001) and a larger group of victims (15.2%, p-value for comparison: <0.001). There were no statistically significant differences between teacher and child data in other bullying involvement groups.

Television viewing and bullying involvement

Latent classes

We identified latent classes of TV exposure at ages 2, 3, 4 and 5 years using LCA. The best fitting model, based on the smallest BIC, was a four-class model (see Additional file 1: Table S1). We considered BIC as a primary indicator of the model fit as this provides a reliable indication of the number of classes. Other model fit criteria were also acceptable, and although the LMR-LRT was still significant in the model with 5 classes, the statistical significance attenuated substantially (see Additional file 1: Table S1).

Latent classes, conditioned on children's probabilities of watching TV for >1 h daily at ages 2, 3, 4 and 5, are presented in Figure 2. Children with the highest probability of watching TV for >1 h daily at all four ages, and children for whom this probability was the lowest were labeled as 'high' and 'low', respectively. Two other classes of children were named 'mid-low' and 'mid-high'. In the mid-low, mid-high and high groups the probabilities of watching >1 h of TV daily increased between ages 2-4 and were considerably lower at age 5 years. This de-

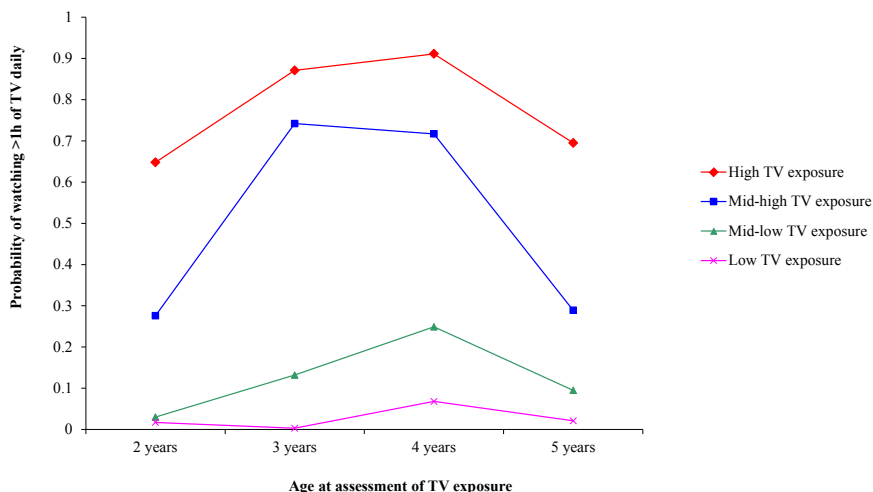


Figure 2. Latent classes of TV exposure conditional on probabilities of watching TV for >1 hour.

crease in the probabilities of TV viewing is probably due to the changes in daily routines and activities at age 4 years, as at this age children usually start preschool in the Netherlands. The distribution of children over the four TV exposure classes was very similar in teacher and child data (see Table 1). Children belonging to the latent class labeled as 'high exposure' had also the highest probabilities of watching TV for >2 h daily throughout ages 2-5, as it is shown in the Additional file 2: Figure S1.

TV exposure and bullying involvement

Association between TV exposure throughout ages 2-5 and bullying involvement (i.e. as a bully, victim, bully-victim vs. uninvolved) was examined using multinomial regression analyses (Table 2). First, we analyzed the association between TV latent classes and child bullying involvement using the teacher data. Univariate analyses (Table 2) showed that high TV exposure between ages 2-5 was associated with a higher risk of being a bully (OR = 1.74, 95%CI: 1.22-2.50) or a victim (OR = 2.38, 95%CI: 1.33-4.28). Children in the mid-high and high TV exposure class were also more likely to be bully-victims. However, in the multivariate analyses, the associations between TV exposure classes and the risk of being a bully, victim or a bully-victim all attenuated and were no longer statistically significant. Next, we studied the association

Table 2 Latent classes of TV exposure between ages 2 and 5 years and bullying involvement in early elementary school

TV exposure latent class	Teacher report (N = 3423)				Peer/self-report (N = 1176)			
	Unadjusted		Adjusted for covariates ^a		Unadjusted		Adjusted for covariates ^a	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Risk of being a bully^b								
Low	Ref		Ref		Ref		Ref	
Mid-low	1.07 (0.79-1.44)	0.66	1.00 (0.74-1.35)	0.99	0.85 (0.51-1.43)	0.54	0.68 (0.39-1.18)	0.17
Mid-high	1.35 (0.98-1.84)	0.07	1.15 (0.83-1.59)	0.42	1.28 (0.75-2.18)	0.37	0.86 (0.47-1.55)	0.61
High	1.74 (1.22-2.50)	0.002	1.27 (0.86-1.86)	0.23	1.33 (0.66-2.65)	0.43	0.71 (0.33-1.54)	0.39
Risk of being a victim^b								
Low	Ref		Ref		Ref		Ref	
Mid-low	1.17 (0.71-1.92)	0.54	1.16 (0.70-1.91)	0.57	0.91 (0.63-1.32)	0.64	0.88 (0.61-1.28)	0.51
Mid-high	1.11 (0.64-1.95)	0.71	1.02 (0.57-1.82)	0.96	0.98 (0.61-1.56)	0.93	0.83 (0.50-1.37)	0.47
High	2.38 (1.33-4.28)	0.004	1.80 (0.94-3.41)	0.07	1.10 (0.57-2.13)	0.77	0.85 (0.43-1.68)	0.63
Risk of being a bully-victim^b								
Low	Ref		Ref		Ref		Ref	
Mid-low	1.21 (0.88-1.65)	0.24	1.08 (0.79-1.48)	0.64	1.71 (0.88-3.32)	0.11	1.36 (0.70-2.65)	0.37
Mid-high	1.73 (1.25-2.40)	0.001	1.31 (0.93-1.85)	0.13	1.95 (0.99-3.83)	0.05	1.21 (0.59-2.46)	0.60
High	2.11 (1.42-3.13)	<0.001	1.35 (0.88-2.08)	0.17	3.68 (1.75-7.74)	0.001	1.60 (0.72-3.55)	0.25

Effect estimates are derived from the multinomial regression analysis. Peer nomination scores were based on ratings by multiple peers.

^a Adjusted for child gender, age, national origin, internalizing and externalizing problems and day-care attendance, and maternal age, parity, education, income, marital status, maternal symptoms of depression, parenting stress. ^b Reference group: 'uninvolved in bullying' children.

between television exposure classes and bullying involvement using the peer/self-reports (Table 2). In the univariate analyses, the mid-high and high television exposure classes were associated with an elevated risk of being a bully-victim (OR = 1.95, 95%CI: 0.99-3.83 and OR = 3.68, 95%CI: 1.75-7.74, respectively). Again, in the multivariate analyses, adjustment for child and maternal covariates substantially attenuated these effect estimates, and they were no longer statistically significant. No other associations between TV exposure and being a victim or a bully were found using the child-reported data.

Additionally, we examined whether exposure to violent TV/video content at age 5 years was associated with children's bullying involvement in the first grades of elementary school. The results of these analyses showed that exposure to violent content at age 5 years was associated with an increased risk of being a bully (OR = 1.27, 95%CI: 1.02-1.58) in early elementary school (see Additional file 3: Table S2).

We further explored which child or maternal factors explained the association between TV exposure classes and bullying involvement (Table 3). Using teacher reports, we examined the association between TV exposure class and bullying involvement, while separately adjusting

Table 3 Confounding patterns of the association between TV exposure between ages 2 and 5 years and teacher report of bullying involvement in early elementary school

TV exposure latent class	Teacher report (N = 3423)									
	Model 1: Unadjusted		Model 1 adjusted for maternal socio-demographic covariates ^a		Model 1 adjusted for maternal psychosocial covariates ^b		Model 1 adjusted for child socio-demographic covariates ^c		Model 1 adjusted for child internalizing and externalizing problems ^d	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
	Risk of being a bully									
Low	Ref		Ref		Ref		Ref		Ref	
Mid-low	1.07 (0.79-1.44)	0.66	1.00 (0.74-1.35)	1.00	1.07 (0.80-1.44)	0.65	1.05 (0.78-1.42)	0.74	1.05 (0.78-1.42)	0.73
Mid-high	1.35 (0.98-1.84)	0.07	1.16 (0.84-1.60)	0.37	1.33 (0.97-1.82)	0.08	1.27 (0.92-1.76)	0.14	1.32 (0.96-1.81)	0.09
High	1.74 (1.22-2.50)	0.002	1.30 (0.90-1.90)	0.16	1.70 (1.18-2.44)	0.004	1.50 (1.03-2.21)	0.04	1.71 (1.19-2.48)	0.004
	Risk of being a victim									
Low	Ref		Ref		Ref		Ref		Ref	
Mid-low	1.17 (0.71-1.92)	0.54	1.13 (0.68-1.86)	0.63	1.16 (0.71-1.91)	0.55	1.13 (0.69-1.87)	0.62	1.17 (0.71-1.92)	0.54
Mid-high	1.11 (0.64-1.95)	0.71	1.03 (0.58-1.84)	0.91	1.09 (0.62-1.92)	0.77	1.00 (0.56-1.76)	0.99	1.09 (0.61-1.92)	0.77
High	2.38 (1.33-4.28)	0.004	1.93 (1.03-3.66)	0.04	2.27 (1.25-4.12)	0.007	1.94 (1.02-3.44)	0.04	2.20 (1.21-3.99)	0.01
	Risk of being a bully-victim									
Low	Ref		Ref		Ref		Ref		Ref	
Mid-low	1.21 (0.88-1.65)	0.24	1.08 (0.79-1.48)	0.63	1.22 (0.89-1.66)	0.21	1.17 (0.86-1.60)	0.32	1.18 (0.87-1.62)	0.28
Mid-high	1.73 (1.25-2.40)	0.001	1.33 (0.94-1.87)	0.11	1.68 (1.21-2.33)	0.002	1.61 (1.16-2.24)	0.005	1.68 (1.21-2.33)	0.002
High	2.11 (1.42-3.13)	<0.001	1.39 (0.91-2.11)	0.13	1.98 (1.33-2.95)	0.001	1.79 (1.19-2.71)	0.005	2.01 (1.35-3.00)	0.001

Effect estimates are derived from the multinomial regression analysis. Reference group: 'uninvolved in bullying' children.

^a Adjusted for maternal age, education, income and marital status. ^b Adjusted for parity, maternal symptoms of depression and parenting stress.

^c Adjusted for child gender, age, national origin, day-care attendance. ^d Adjusted for child internalizing and externalizing problems. For fully adjusted model see Table 2.

the association for the following clusters of covariates: (a) *maternal socio-demographic factors*: maternal age, education, household income and marital status; and (b) *maternal psychosocial covariates*: depression symptoms and parenting stress; (c) *child socio-demographic characteristics*: gender, age, national origin, day-care attendance; (d) *child internalizing and externalizing problems*. We compared the unadjusted results to results obtained after adjustment for each of the separate groups of covariates (Table 3). Using teacher data, we found that the association between TV exposure class and the risk of being a *bully* or a *bully-victim* was largely confounded by maternal socio-demographic characteristics (for high exposure class $OR_{bully} = 1.30$, 95%CI: 0.90-1.90 and $OR_{bully-victim} = 1.39$, 95%CI: 0.91-2.11). Additional analyses with individual covariates of this group of covariates showed that the association attenuated mainly due to *maternal age, educational level and household income*. Similar analyses in child-reported data also showed that the effect of television viewing that was found for bully-victims was confounded by these maternal socio-demographic characteristics (see Additional file 4: Table S3). Adjustment of the association for the other clusters of covariates also resulted in an attenuation of the univariate effect estimates, however that attenuation of the effects was smaller than that after controlling for the maternal socio-demographic covariates. Adjusting the analyses jointly for all covariates resulted in the strongest attenuation of the effects, as can be seen by comparing the separate adjustment models in Table 3 with the fully adjusted model presented in Table 2.

Finally, we additionally examined the association between TV viewing and bullying involvement by analyzing the separate exposure measurements of television viewing at each of the four different ages. As shown in Additional file 5: Tables S4, Additional file 6: Table S5, Additional file 7: Table S6 and Additional file 8: Table S7, we found no effect of television viewing on bullying or victimization at any of the ages.

DISCUSSION

We studied child television exposure throughout ages 2-5 years in relation to teacher- and peer/self-reports of bullying involvement in early elementary school. In the univariate analyses, we observed an association between high television exposure and the risk of being involved in school bullying; however, this association attenuated after adjustment for the covariates. This finding was consistent in both teacher- and peer/self-reported data. These results differ from the findings of two other prospective studies: Pagani et al [25], who found that each extra hour of television viewing at age 2.4 years led to 10% unit increase in peer victimization at age 10 years; and Zimmerman et al [24], who reported that each additional hour of television viewed per day at age 4 years was significantly associated with an odds ratio of 1.06 for bullying at age 6-11 years. The effect estimates reported in those studies were rela-

tively small, yet statistically significant and, in contrast to our findings, remained significant after adjustment for child and family factors.

Several possible explanations of the discrepancies between our findings and the results of earlier studies should be considered. Our measure of exposure was different. Also, we showed that there are specific covariates (e.g. maternal age, educational level and family income) that strongly confound the association between television viewing and bullying involvement. Similarly, other studies showed that these family characteristics are related to both – bullying [2] and child television viewing [39]. Unlike in the studies of Pagani and Zimmerman [24,25], we adjusted our analyses for child internalizing and externalizing problems at age 18 months. Child behavioral problems may be important potential confounding factors because television viewing is known to be associated with child externalizing problems [22]; and child internalizing and externalizing problems are associated with bullying involvement [7]. Furthermore, the adjustment for early age behavioral problems helped us eliminate a concern that children may watch TV as a result of their pre-existing problems, as parents of children with behavioral problems may be more inclined to allow TV viewing [40,41]. Our findings show that children's internalizing and externalizing problems do, to some extent, confound the association between TV exposure and bullying involvement, as the effect estimates decreased after adjustment for child problem behavior (as shown in Table 3). However, the most substantial decrease in effect estimates resulted from the adjustment for maternal socio-demographic variables (Table 3), demonstrating that both children's high television exposure and bullying involvement are strongly related to such underlying factors as maternal age, educational level and income.

In our study, children's exposure to violent TV/video content at age 5 years was associated with the risk of being a bully, but not with the risk of being a victim or a bully-victim. Several possible explanations of this finding should be considered. The content-based theories suggest that children learn from observing violence, which is thought to effect children's aggressive behavior [23,42]. Following this approach, exposure to violent content may trigger the aggressive behavior of bullies. Possibly, observing this effect in the group of bullies, but not in the group of bully-victims could be due to different effects of violent content on proactive vs reactive aggression. We may speculate that the exposure to violence has a stronger effect on proactive aggression of bullies rather than on reactive aggression of bully-victims. Yet, this interpretation needs further in depth, possibly qualitative examination. Finally, due to the cross-sectional nature of this specific analysis, we cannot infer causality or establish the direction of the association (i.e. the data were collected prospectively, however the age difference between the assessments was not large and children's bullying involvement was measured only once, precluding adjustment for bullying involvement at baseline). While it is plausible that viewing of violent content leads to bullying behavior, it is also possible that aggressive children, who are involved in bullying at school-entry age, have a stronger preference for viewing violent TV/video programs [17,43].

In order to avoid the problem of shared method variance and possible reporter bias, multiple informants were used in our study. Relying on teacher or parent as the only informant may be insufficient, and complementary information can be obtained from peers who, compared to a teacher or a parent, are often more aware of peer relations in a class. The peer/self-report of bullying involvement used in our study is a composite measure of the self-reported victimization and the peers' reports of bullying. Allowing all the children in a class rate one another with regard to bullying involvement provides a reliable measure of bullying involvement from the perspective of the entire group. Such approach eliminates possible bias that can be introduced by the use of only teacher or parent report. In the previous studies, bullying assessment was confined to maternal [24] or teacher [25] report only. Our findings show that the effects of television viewing on child-reported bullying were, if anything, smaller than the effects found in teacher data; although, for the group of bully-victims the strength of the effect estimates was very similar in the teacher and child data.

In sum, our findings provide some support for the content-based theory, as watching violent television content at age 5 years was associated with the teacher report of bullying involvement at age 7 years. However, this finding should be replicated using longitudinal data in order to determine the direction of the association. Our findings further suggest that the observed negative effects of the television exposure time on bullying involvement, reasoned to occur due to excessive TV viewing according to the displacement theory, are confounded by maternal and child socio-demographic characteristics. Maternal socio-demographic characteristics (i.e. maternal age, education, income, marital status) appear to be the underlying factors associated with both children's excessive television exposure and bullying involvement.

The relation between these maternal socio-demographic characteristics and child behavior – i.e. an excessive television viewing, bullying involvement – has been reported in earlier studies [2,39,44]. A young age, low socioeconomic background and being a single parent are associated with negative outcomes in child development. Children of younger mothers are more likely to show developmental problems, e.g. behavioral problems, which is likely due to these children being brought up in a rather disadvantaged environment [45]. Fergusson and Lynskey [45] explain that children born to younger mothers are brought up in families that are socially and educationally disadvantaged, and also less nurturing and more unstable. Family's socioeconomic disadvantage is associated with children's emotional and behavioral problems, either directly (e.g. stress-induced) or through parenting practices [46,47]. Socio-demographic characteristics, like parental educational level and income, also reflect various resources and skills, including intellect, literacy, problem-solving skills, and norms and values of a parent [48,49], that can influence children's social development and behavior through parental rearing practices [50]. Similarly, being a single parent may negatively affect the upbringing practices and parent-child interactions through its inherent stress and reduced parental control over child's behavior [2]. Importantly, having understood the role of these

socio-demographic characteristics, they can be used as indicators in identifying the vulnerable groups of children at risk of behavioral problems. These vulnerable groups can then be targeted by prevention and intervention programs aimed at prevention of excessive media use and bullying involvement. For instance, future studies could examine whether intervention programs aiming to enhance knowledge, problem-solving skills and parenting practices of socioeconomically disadvantaged parents could yield positive effects with regard to both outcomes – media exposure and peer interactions of young children.

Our study's major strengths are the use of multiple reporters and repeated assessments of the exposure at preschool age. Yet, several limitations of the present study should be discussed. First, we used parental report of television exposure which is inferior to observational or diary-based measures. However, in large data collections required for population-based studies such as the present one, (parental) questionnaires are the most feasible assessment method of child television exposure. Second, our measure of children's exposure to violent content was not very detailed. As already discussed above, this measure was assessed only once, when children were 5 years old, and thus it did not allow longitudinal examination of the relation. Importantly, our measure of content contained information on whether or not the children watched violent content on TV/video, but not on the duration or the actual content of the programs watched. The exposure to specific television programs may be associated differently with bullying involvement than the duration of such TV exposure as a whole. Thus, an objective and more detailed measure of the violent content could have resulted in a stronger association with children's bullying behaviors. Future studies should also consider the role of other important factors, such as children's exposure to aggression or abuse in real life. Also, using continuous measure of TV viewing can offer more precision. We used categorical measures of exposure; however, these measures had multiple categories that reflected daily hours of TV viewing, which in combination with multiple assessments over time were likely to provide sufficient information on children's TV viewing. Finally, we did not have information on children's bullying involvement prior to school entry, thus we were not able to examine whether television viewing could predict incidence of bullying involvement.

CONCLUSIONS

In summary, our findings demonstrate that a child's risk of bullying involvement in early elementary school that is associated with preschool television exposure is largely explained by confounding factors – primarily maternal socio-demographic characteristics. Our results suggest that social disadvantage, as indicated by the socioeconomic factors such as low income and lower educational level, may pose the actual risk for high television viewing at preschool age and for bullying involvement in early elementary school. This should be further examined in future studies.

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SUPPLEMENTARY MATERIAL

Table S1. LCA models characteristics (N=5389).

Number of classes	BIC ^a	p-value for LMR-LRT ^b
1	43467.1	NA
2	40513.4	<0.0001
3	39792.6	<0.0001
4	39736.0	<0.0001
5	39814.8	0.0096

^a A lower value of BIC indicates a better fit of the model.

^b The LMR-LRT compares the fit of two models that differ by one class. A non-significant value indicates that the model with one class less is preferred.

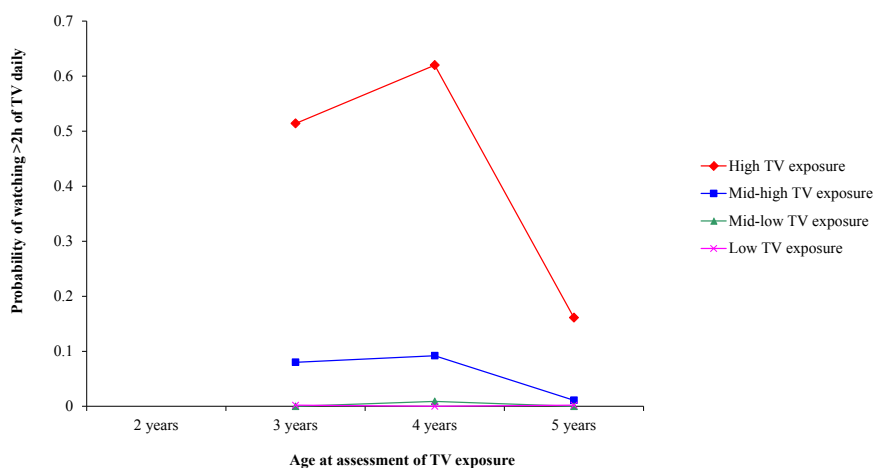
**Figure S1** Latent classes of TV exposure conditional on probabilities of watching TV >2 hours.

Table S2. Exposure to violent TV/video content and bullying involvement in early elementary school

Exposure to violent TV/video content at age 5 years	Teacher report (N=2999)				Peer/self-report (N=1053)			
	Unadjusted		Adjusted for covariates ^a		Unadjusted		Adjusted for covariates ^a	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
	Risk of being a bully^b							
No	Ref		Ref		Ref		Ref	
Yes	1.28 (1.04-1.59)	0.02	1.27 (1.02-1.58) ^c	0.03	1.30 (0.91-1.86)	0.15	1.10 (0.74-1.63)	0.65
	Risk of being a victim^b							
No	Ref		Ref		Ref		Ref	
Yes	0.93 (0.64-1.35)	0.69	0.93 (0.63-1.38)	0.71	1.10 (0.77-1.59)	0.59	1.26 (0.85-1.89)	0.25
	Risk of being a bully-victim^b							
No	Ref		Ref		Ref		Ref	
Yes	1.12 (0.89-1.42)	0.34	1.07 (0.84-1.38)	0.58	1.16 (0.74-1.82)	0.67	1.02 (0.63-1.64)	0.95

Effect estimates are derived from the multinomial regression analysis. Peer nomination scores were based on ratings by multiple peers.

^a Adjusted for child gender, age, national origin, internalizing and externalizing problems and day-care attendance, and maternal age, parity, education, income, marital status, maternal symptoms of depression, parenting stress. ^b Reference group: 'uninvolved in bullying' children.

^c If additionally adjusted for the TV exposure classes: OR=1.26 (95%CI: 1.01-1.57), p=0.04.

Table S3. Confounding patterns of the association between TV exposure at 2-5 years and peer/self-reported bullying involvement in early elementary school

TV exposure latent class		Peer/self-report (N=1176)											
		Model 1: Unadjusted		Model 1 adjusted for maternal socio-demographic covariates ^a		Model 1 adjusted for maternal psychosocial covariates ^b		Model 1 adjusted for child socio-demographic covariates ^c		Model 1 adjusted for child internalizing and externalizing problems ^d			
		OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value		
Risk of being a bully													
Low		Ref		Ref		Ref		Ref		Ref			
Mid-low		0.85 (0.51-1.43)	0.54	0.72 (0.42-1.21)	0.21	0.82 (0.49-1.39)	0.46	0.77 (0.45-1.33)	0.35	0.84 (0.50-1.42)	0.52		
Mid-high		1.28 (0.75-2.18)	0.37	0.90 (0.52-1.58)	0.72	1.20 (0.70-2.08)	0.51	1.07 (0.60-1.91)	0.82	1.24 (0.73-2.13)	0.43		
High		1.33 (0.66-2.65)	0.43	0.79 (0.38-1.65)	0.53	1.19 (0.59-2.40)	0.63	0.95 (0.45-2.01)	0.89	1.25 (0.62-2.50)	0.53		
Risk of being a victim													
Low		Ref		Ref		Ref		Ref		Ref			
Mid-low		0.91 (0.63-1.32)	0.64	0.87 (0.60-1.26)	0.45	0.90 (0.62-1.30)	0.57	0.92 (0.63-1.34)	0.68	0.91 (0.63-1.32)	0.63		
Mid-high		0.98 (0.61-1.56)	0.93	0.81 (0.51-1.30)	0.39	0.98 (0.62-1.56)	0.93	0.96 (0.59-1.57)	0.87	0.98 (0.61-1.56)	0.85		
High		1.10 (0.57-2.13)	0.77	0.81 (0.42-1.57)	0.53	1.10 (0.57-2.12)	0.77	1.12 (0.58-2.17)	0.74	1.10 (0.57-2.13)	0.77		
Risk of being a bully-victim													
Low		Ref		Ref		Ref		Ref		Ref			
Mid-low		1.71 (0.88-3.32)	0.11	1.39 (0.72-2.68)	0.33	1.65 (0.84-3.23)	0.14	1.54 (0.78-3.03)	0.21	1.70 (0.87-3.31)	0.12		
Mid-high		1.95 (0.99-3.83)	0.05	1.18 (0.60-2.34)	0.64	1.87 (0.95-3.69)	0.07	1.57 (0.78-3.17)	0.20	1.91 (0.97-3.74)	0.06		
High		3.68 (1.75-7.74)	0.001	1.64 (0.73-3.64)	0.23	3.47 (1.65-7.32)	0.001	2.39 (1.09-5.26)	0.03	3.51 (1.67-7.41)	0.001		

Reference group: 'uninvolved in bullying' children. Peer nomination scores were based on ratings by multiple peers.

^a Adjusted for maternal age, education, income and marital status. ^b Adjusted for parity, maternal symptoms of depression and parenting stress. ^c Adjusted for child gender, age, national origin, day-care attendance. ^d Adjusted for child internalizing and externalizing problems. For fully adjusted model see Table 2.

Table S4. TV exposure at age 2 years and bullying involvement in early elementary school

TV exposure at age 2 years	Teacher report (N=3111)		Peer/self-report (N=1067)	
	Adjusted for covariates ^a		Adjusted for covariates ^a	
	OR (95% CI)	p-value	OR (95% CI)	p-value
	Risk of being a bully			
Never	Ref		Ref	
<0.5 hour	1.29 (0.80-2.09)	0.29	1.18 (0.54-2.58)	0.63
0.5-1 hour	1.12 (0.69-1.82)	0.65	0.98 (0.42-2.27)	0.20
>1 hour	1.34 (0.80-2.27)	0.27	1.22 (0.48-3.09)	0.84
	Risk of being a victim			
Never	Ref		Ref	
<0.5 hour	2.69 (0.81-8.97)	0.11	1.06 (0.54-2.07)	0.86
0.5-1 hour	1.97 (0.58-6.64)	0.28	0.92 (0.46-1.86)	0.82
>1 hour	3.38 (0.99-11.56)	0.05	0.89 (0.39-2.06)	0.79
	Risk of being a bully-victim			
Never	Ref		Ref	
<0.5 hour	0.64 (0.39-1.04)	0.07	1.72 (0.52-5.75)	0.38
0.5-1 hour	0.82 (0.50-1.34)	0.43	1.82 (0.55-6.02)	0.33
>1 hour	0.85 (0.50-1.42)	0.53	1.40 (0.39-5.02)	0.60

Reference group: 'uninvolved in bullying' children. Peer nomination scores were based on ratings by multiple peers.

^a Adjusted for child gender, age, national origin, internalizing and externalizing problems and day-care attendance, and maternal age, parity, education, income, marital status, maternal symptoms of depression, parenting stress.

Table S5. TV exposure at age 3 years and bullying involvement in early elementary school

TV exposure at age 3 years	Teacher report (N=2938)		Peer/self-report (N=1016)	
	Adjusted for covariates ^a		Adjusted for covariates ^a	
	OR (95% CI)	p-value	OR (95% CI)	p-value
	Risk of being a bully			
Never and <0.5 hour	Ref		Ref	
<0.5-1 hour	0.95 (0.71-1.26)	0.71	0.66 (0.39-1.12)	0.13
1-2 hours	1.09 (0.80-1.50)	0.57	0.85 (0.48-1.51)	0.57
>2 hours	1.00 (0.65-1.53)	0.98	0.72 (0.32-1.59)	0.42
	Risk of being a victim			
Never and <0.5 hour	Ref		Ref	
<0.5-1 hour	1.51 (0.89-2.56)	0.12	0.80 (0.53-1.21)	0.29
1-2 hours	1.36 (0.75-2.45)	0.31	0.87 (0.51-1.48)	0.61
>2 hours	1.80 (0.86-3.75)	0.12	0.61 (0.24-1.55)	0.30
	Risk of being a bully-victim			
Never and <0.5 hour	Ref		Ref	
<0.5-1 hour	0.97 (0.71-1.31)	0.83	1.40 (0.77-2.55)	0.27
1-2 hours	1.30 (0.93-1.82)	0.12	1.32 (0.65-2.69)	0.45
>2 hours	1.17 (0.74-1.87)	0.50	2.06 (0.81-5.25)	0.13

Reference group: 'uninvolved in bullying' children. Peer nomination scores were based on ratings by multiple peers.

^a Adjusted for child gender, age, national origin, internalizing and externalizing problems and day-care attendance, and maternal age, parity, education, income, marital status, maternal symptoms of depression, parenting stress.

Table S6. TV exposure at age 4 years and bullying involvement at early elementary school

TV exposure at age 4 years	Teacher report (N=2967)		Peer/self-report (N=1036)	
	Adjusted for covariates ^a		Adjusted for covariates ^a	
	OR (95% CI)	p-value	OR (95% CI)	p-value
	Risk of being a bully			
<0.5 hour	Ref		Ref	
0.5-1 hour	0.80 (0.54-1.18)	0.27	0.84 (0.45-1.56)	0.58
1-2 hours	0.80 (0.53-1.21)	0.30	1.15 (0.58-2.31)	0.69
>2 hours	0.99 (0.61-1.63)	0.98	0.97 (0.41-2.29)	0.95
	Risk of being a victim			
<0.5 hour	Ref		Ref	
0.5-1 hour	0.70 (0.40-1.22)	0.23	2.03 (1.02-4.07)	0.04
1-2 hours	0.63 (0.33-1.20)	0.56	1.46 (0.72-2.98)	0.29
>2 hours	1.34 (0.67-2.69)	0.40	2.12 (0.86-5.22)	0.10
	Risk of being a bully-victim			
<0.5 hour	Ref		Ref	
0.5-1 hour	1.03 (0.66-1.60)	0.90	0.59 (0.33-1.06)	0.08
1-2 hours	1.10 (0.69-1.75)	0.68	0.61 (0.32-1.16)	0.13
>2 hours	1.28 (0.73-2.24)	0.39	0.85 (0.38-1.93)	0.70

Reference group: 'uninvolved in bullying' children. Peer nomination scores were based on ratings by multiple peers.

^a Adjusted for child gender, age, national origin, internalizing and externalizing problems and day-care attendance, and maternal age, parity, education, income, marital status, maternal symptoms of depression, parenting stress.

Table S7. TV exposure at age 5 years and bullying involvement at early elementary school

TV exposure at age 5 years	Teacher report (N=3124)		Peer/self-report (N=1091)	
	Adjusted for covariates ^a		Adjusted for covariates ^a	
	OR (95% CI)	p-value	OR (95% CI)	p-value
	Risk of being a bully			
<0.5 hour	Ref		Ref	
0.5-1 hour	0.98 (0.63-1.51)	0.91	0.56 (0.29-1.10)	0.33
1-2 hours	0.90 (0.55-1.45)	0.66	0.64 (0.29-1.42)	0.10
>2 hours	1.07 (0.52-2.21)	0.85	1.40 (0.35-5.65)	0.66
	Risk of being a victim			
<0.5 hour	Ref		Ref	
0.5-1 hour	0.65 (0.32-1.30)	0.22	1.00 (0.49-2.08)	0.99
1-2 hours	0.88 (0.41-1.88)	0.75	1.28 (0.55-2.99)	0.57
>2 hours	0.75 (0.22-2.50)	0.63	1.34 (0.22-8.05)	0.75
	Risk of being a bully-victim			
<0.5 hour	Ref		Ref	
0.5-1 hour	1.59 (0.88-2.85)	0.12	0.73 (0.30-1.78)	0.50
1-2 hours	1.68 (0.91-3.10)	0.10	1.07 (0.38-3.00)	0.90
>2 hours	1.21 (0.48-3.04)	0.69	1.94 (0.34-10.94)	0.46

Reference group: 'uninvolved in bullying' children. Peer nomination scores were based on ratings by multiple peers.

^a Adjusted for child gender, age, national origin, internalizing and externalizing problems and day-care attendance, and maternal age, parity, education, income, marital status, maternal symptoms of depression, parenting stress.

Chapter 10

General Discussion

RATIONALE

Little is known about bullying processes in early elementary school. This is unfortunate, because at this age timely detection of bullying problems may help prevent the negative, and often long-lasting, health consequences among those affected by these problems. Large population-based studies of young elementary school children are needed to inform public health professionals about the prevalence of bullying at young age and about the associated risk factors. Yet, such studies are uncommon.

The general objective of this thesis was to examine bullying processes among elementary school children from the population-based perspective. The research presented in this thesis focused primarily on: (1) assessment of bullying at young age and estimation of its prevalence in early elementary school, (2) studying socioeconomic and demographic differences in bullying involvement at young age, and (3) examining early-age risk factors associated with bullying and victimization in elementary school.

The population-based perspective

Our study on the prevalence of bullying involvement at young age was embedded in the Rotterdam Youth Health Monitor – a population-based survey of health and well-being of children and youth, which is regularly carried out by the Municipal Public Health Service in Rotterdam, the Netherlands. This survey was carried out in the academic year 2008-2009 among the teachers and parents of children attending grades 1-2 of elementary school in Rotterdam and city suburbs. Using this representative and large sample of teacher reports, we estimated the prevalence of bullying involvement among children in early elementary school. In the same population-based study, we examined the socioeconomic factors affecting bullying involvement at this age.

Another study was set up in order to develop and evaluate a web-based, interactive instrument for an assessment of peer relations in the first grades of elementary school. In this study children reported about their peer relations. For this, we used the peer nomination method. We examined the psychometric properties of this instrument using a large sample of peer/self-reports of elementary school children from grades 1-2 in Rotterdam, the Netherlands. Using a subsample of this study, we conducted research to examine the sex differences in peer relations of young children.

The studies on early-age predictors of behavioral problems and bullying were embedded in the Generation R Study¹, a prospective population-based birth cohort of children in Rotterdam, the Netherlands. The Generation R cohort is set up to study child development from fetal life onwards. It offers a unique opportunity to examine environmental and genetic influences on child health. Characteristics of the participating children, their behavior and exposures throughout preschool and school age have been regularly assessed.² The wealth of these data allowed us to examine the role of such potential risk factors as child preschool

behavioral problems, cognitive functioning, body mass index and preschool television viewing in relation to bullying involvement at school.

MAIN FINDINGS

Prevalence of bullying involvement in early elementary school

Whereas there have been some reports of bullying involvement as early as at kindergarten age,^{3,4} most studies that assessed prevalence of bullying and victimization focused on late elementary or secondary school children.^{5,6} In this thesis, we studied bullying involvement in children attending the first grades of elementary school. Based on teacher reports from a large population-based survey, we concluded that bullying involvement at young age is prevalent; although the rates of bullying involvement at this age are somewhat different from the rates of bullying involvement at older ages.⁵ As described in chapter 2, on average about a third of elementary school children at age 5-6 years are involved in bullying either as a bully (17%), victim (4%) or a bully-victim (13%). The rates of bullying involvement at older ages, especially as a bully or a bully-victim, are typically somewhat lower.⁷ This is not surprising as studies of young children show that at younger age children tend to show relatively high levels of (peer) aggression.^{3,8-10} Also, it is well-established that the rates of bullying and victimization tend to decrease with age.^{7,11} In our study of young children, the most prevalent types of bullying (physical, verbal and relational) corresponded to the most common types of bullying reported by older children.¹² Consistent with the commonly reported sex differences,^{12,13} boys were more often involved in overt types of bullying (e.g. physical or verbal) and girls engaged more often in relational bullying. In sum, our findings suggest that the prevalence and patterns of bullying involvement at young age are largely similar to those observed in older children.

Socioeconomic disparities

In light of the scientific reports about the importance of neighborhood socioeconomic status in relation to negative behavioral and health outcomes,¹⁴ we examined the effects of the neighborhood socioeconomic status on bullying involvement. We tested a hypothesis that attending schools in a socioeconomically disadvantaged neighborhood (reflected in the educational level, income and unemployment rates of the residents in the neighborhood) is associated with bullying involvement, even once the *family* socioeconomic disadvantage is accounted for. Our findings showed that attending schools in the socioeconomically disadvantaged areas predicts bullying. However, examining it together with the family factors allowed us to conclude that the family socioeconomic disadvantage is more salient for the risk of bullying involvement. Generally, we observed that bullying and victimization as a whole, and each type of bullying involvement separately, were more prevalent in children of moth-

ers with lower educational level than in children of mothers with higher educational level. In reference to the specific risks of becoming a bully or a bully-victim, the primary predictors were the family socioeconomic characteristics (i.e. single parenthood, young parental age, low educational level of parents and parental unemployment), even if the low neighborhood socioeconomic status was accounted for. Similarly, the specific risk of becoming a victim was also associated with low socioeconomic status of the family, namely with low parental education. Family socioeconomic characteristics, as reflected in e.g. low parental education, lower income and young parental age, most likely affect child development directly and indirectly. It has been suggested that socioeconomic status is likely to exert its negative effect on peer aggression through: parental harsh discipline, lack of maternal warmth, exposure to aggressive adult models, maternal aggressive values, family life stressors, mother's lack of social support, peer group instability, and lack of cognitive stimulation.¹⁵ Altogether, our findings show that children from low socioeconomic families are more likely to be involved in bullying, and this vulnerability is present already at the start of elementary school.

The use of peer nomination method in early elementary school

An important goal of this thesis was to use the peer nomination method in a population-based sample of elementary school children. When perusing this goal we discovered that the use of the peer nomination method in a large-scale longitudinal study of young children requires certain level of creativity. The first challenge is that children participating in the cohort spread across different schools during the follow-up. Second, researchers who previously used this method with young children (usually in smaller-scale studies) conducted interviews,^{3,8,16-18} and often used illustrations and photographs to help young children with the nominations. Thus, we faced a difficult task of finding a feasible and relatively efficient way of using the peer nomination method with young children in early elementary school, while avoiding the elaborate and time-consuming individual interviews.

Following the successful examples of studying peer relations with the help of illustrations/cartoon methodology,^{3,19} we developed an animated assessment instrument – the PEERS Measure. In this interactive, computerized measure, the questions about bullying and victimization were asked using illustrations depicting bullying situations. The illustrations were accompanied by audio instructions and explanations. Similarly to previous studies in young children,^{3,8,16-18} our participants were shown the photographs of their peers to allow nominations. In the PEERS Measure, in order to answer the questions children could nominate their classmates by clicking on their photographs.

The psychometric properties of the PEERS Measure were tested in a large sample of elementary school children in Rotterdam, the Netherlands (chapter 3). The relations between the studied concepts were consistent with prior research²⁰⁻²³ (e.g. we observed a strong correlation between defending and prosocial behavior and e.g. between bullying and peer rejection). High correlation coefficients and ICC coefficients between the test–retest measures

suggest that the PEERS Measure has good reliability. The correlations of peer-reported bullying with aggressive behavior reported by a child him- or herself or by a teacher were in the expected range. The observed sex differences (e.g. more bullying involvement among boys) and the socioeconomic differences (e.g. more bullying among ethnic-minority children and children of mothers with lower educational levels) are in line with the observations reported in previous studies.^{20,23-30} To conclude, our findings suggest that the PEERS Measure is a reliable and age-appropriate instrument that can be used to collect dyadic/network data about children's peer relations as early as in the first grades of elementary school. Also, this instrument can be used by teachers to monitor the group processes in a class; however, the analyses and interpretation of the sociometric data requires certain level of expertise. Thus, either the instrument needs to be programmed to generate the tailored reports automatically or the assessments need to be carried out by a trained researcher.

Sex difference in peer relations at young age

Relatively little is known about positive and negative dyadic peer relations at young age and about the role of sex differences in these relations. In the study presented in chapter 4, we examined the group dynamics in early elementary school 'under the magnifying glass'. We studied dyadic peer relations of young children in the same-sex and other-sex interactions. We examined how such behaviors as bullying, victimization and defending are associated with peer acceptance and rejection, and whether these associations are different in the same-sex and other-sex dyadic relations.

As expected, boys were generally more often nominated as bullies. Sex differences in young children were also observed with regard to peer acceptance. Both boy and girls were more likely to nominate same-sex peers when answering questions about peer acceptance. Furthermore, in the questions about peer acceptance, children were more likely to nominate their defenders, and it was irrespective of whether the victim-defender dyad was a same- or other-sex relation. Children who defended other-sex peers were even more likely to be accepted by other-sex classmates. With regard to peer rejection: bullies were rejected by boys if the victims of the bullies were boys; and similarly, if the victims of the bullies were girls then these bullies were more likely to be rejected by girls. With regard to rejection of the victims we observed that: the victims of male bullies were more rejected by other boys, whereas the victims of female bullies were more rejected by other girls.

The peer relations in early elementary school differed in some ways from the typical relations in adolescence. For instance, in preadolescence boys who bully other boys are usually rated high on peer acceptance by girls.³¹ This was not the case in our study of young children. Possibly, at a young age it is more normative for (other-sex) children to negatively evaluate the aggressive behavior of a bully. Also, it may be that at older age, the aggressive traits of a bully become more 'attractive' to the opposite sex.³²

The findings of our study showed that at the start of elementary school many important peer processes, such as bullying, rejection and defending, are heavily influenced by child sex. The study also showed that, in spite of few differences, the observed ingroup and outgroup processes in early elementary school are largely similar to those observed in preadolescence.

Early-age risk factors associated with bullying involvement

Behavioral problems

The bidirectional relation between behavioral problems and bullying involvement has been an issue of discussion among researchers studying the origins of aggressive behavior.³³ At the same time, prospective studies that could examine an antecedent effect of early-age behavioral problems on bullying are largely lacking. Having considered that ADHD and ODD/CD problems are frequently implicated in peer problems³⁴ and are among the most common disorders in childhood,³⁵⁻³⁷ in chapter 5 of this thesis, we examined the temporal antecedence of child attention deficit hyperactivity problems and oppositional defiant problems in relation to school bullying. We found that children with higher behavioral problem scores at age 3 years had an increased risk of becoming a bully or a bully-victim in the first grades of elementary school. Our findings are consistent with previous studies showing that, children with attention deficit hyperactivity problems and oppositional defiant problems tend to have problematic peer relations.³⁸⁻⁴¹ Given the disruptive nature of the behavior that is typically demonstrated by children with these problems,⁴²⁻⁴⁵ it is explicable that they had an increased risk of becoming a bully or a bully-victim. Children with ADHD or ODD problems are likely to have elevated levels of aggression and impulsivity. Therefore, it is much less likely that these children become (pure) victims. The behavior of children with ADHD or ODD is almost the opposite of the behavior of pure victims. The pure victims usually do not retaliate when bullied and do not act provocatively, and thus are less likely to prompt negative response from their peers. Importantly, in this study we showed that children, whose behavioral problems throughout preschool age were high or increasing, were at more risk of becoming a bully or a bully-victim than children whose behavioral problem remained low or decreased before school entry. Altogether, our findings indicated that early-age behavioral problems can predispose children to bullying involvement at school.

Executive function and intelligence

In chapter 6, we examined a cross-sectional association of child executive function and non-verbal intelligence with bullying involvement at school. In our study, primarily the poor inhibition was associated with bullying involvement. This effect was most conspicuously across different bullying involvement groups. The effect was most pronounced in the groups of bullies and bully-victims. Also, this effect was independent of child IQ or child ADHD problems. In our study, inhibition reflected primarily the ability of a child not to act upon impulse. Consider-

ing that poor inhibition has been associated with reactive aggression,⁴⁶ we may assume that the observed effect in our study (in bullies and particularly in the bully-victims) reflects the poor inhibition implicated in their reactive aggression. Struggling to inhibit immediate verbal or behavioral responses in a conflict situation is an example of these children's general inability to control themselves in a social situation, which may explain why these children have troubled peer relations.

Also, we found that children experiencing working memory problems faced an elevated risk of becoming a bully, although the statistical significance of this finding was only marginal. Poor working memory function may be responsible for difficulties with remembering and following the rules, or it may be associated with the difficulty to apply an appropriate behavioral strategy during a peer conflict. Also, we observed a protective effect of IQ. Children with higher non-verbal IQ were less often involved in bullying as a victim or a bully-victim. Similarly, earlier studies showed a negative association between IQ and aggression⁴⁷ and IQ and delinquency.⁴⁸ Most likely, children with lower IQ may lack cognitive skills to learn complex nonaggressive social problem-solving skills,⁴⁷ or they may struggle to learn the alternative strategies of goal achievement. Also, child IQ may undermine school performance⁴⁸ or self-esteem⁴⁷ of these children, making them vulnerable to peer problems. In contrast, children with higher IQ may be more skilled in either preventing or effectively solving peer conflicts. Overall, even though the observed effects in our study were not large, they indicated that peer relations in early elementary school are at least to some extent influenced by children's cognitive function and executive function. Our findings suggest that executive function problems, marked by poor inhibition and poor working memory, and lower non-verbal IQ are associated with a risk of bullying involvement at school.

Overweight

In chapter 7, we showed that, in early elementary school a higher body mass index of a child is associated with an increased risk of bullying and victimization. However, the higher BMI scores were associated with bullying among boys but not among girls. In particular, the higher BMI increased the risk of boys demonstrating physical bullying towards their peers. Importantly, our findings across the specific bullying involvement roles showed that, in comparison to the normal-weight peers, obese children were more frequently involved in bullying as bully-victims, rather than merely bullies or victims. Altogether, our study suggests that higher body mass index may increase children's vulnerability to bullying and victimization. The results of our study are in line with the findings of the studies that were carried out among older children.⁴⁹⁻⁵² Different mechanisms may be involved in the association of the high BMI with bullying involvement. On the one hand, children with overweight/obesity are more likely to be stigmatized and to be less liked by their peers⁵³; also, they often face more peer rejection, which can make them more vulnerable to peer victimization.⁵⁴ Additionally, children may internalize the negative normative beliefs of their peers with regard to their overweight/obesity

and may subsequently behave in ways that reinforce these beliefs. In turn, peer victimization of heavy children has been suggested to influence the lifestyle and unhealthy behavior of these children.⁵⁴ Thus, there may be a reciprocal association between these factors, which may lead to an exacerbation of the problems. On the other hand, children with higher weight may possess more physical strength, which may provide them with a certain advantage over a weaker victim, possibly explaining their engagement in bullying. This explanation may be plausible as boys had an increased risk of demonstrating physical forms of bullying towards their peers. Considering that obesity was associated with an increased risk of becoming a bully-victim, the bullying behavior of obese children may be interpreted as an expression of reactive aggression in response to being victimized by their peers. Importantly, both the higher body mass index and involvement in school bullying can also be the outcomes of a shared underlying cause (e.g. low self-esteem, earlier internalizing/externalizing problems, ADHD or low self-control). A study in middle-school students pointed out that self-control may have a strong influence on bullying among children who are heavier than their peers.⁴² Therefore, the association between weight and bullying involvement may be dependent on child self-regulation ability, suggesting that physically larger children with low self-control could be more likely to engage in bullying. Alternatively, both the excess weight of a child and involvement in bullying could be the manifestations of the impaired self-control. Finally, the comorbid developmental problems of overweight/obese children (e.g. ADHD⁴²) could be part of the mechanism explaining the increased risks of obese children engaging in school bullying.

Effects of excessive television exposure

In chapters 8 and 9 of this thesis we studied the effects of extensive television exposure at young age on externalizing problems at preschool age and on bullying involvement at school. As described in chapter 8, we examined whether time span of television viewing patterns at ages 24 months and 36 months were associated with incidence or persistence of externalizing problems at age 36 months. We found that (sustained) high television exposure at 24 and 36 months was associated with the incidence of externalizing problems and with the persistence of the pre-existing externalizing problems. Therefore, our findings indicate that lengthy television viewing may increase the likelihood of externalizing problems in preschool children. Extensive exposure to media can influence development of a child in several ways. For instance, it affects behavior and daily activities, of young children. Specific examples of such potential influences are: social learning from aggressive models (if exposed to aggressive television content), displaced other activities, which ordinarily encourage development of a child (such as play with peers or reading with a parent), and an overstimulation with inappropriate for young age content (e.g. rapid pace, visual/audio effects).⁵⁵

In chapter 9, we examined whether television exposure patterns throughout preschool age increase a child's risk of bullying involvement at school. If parents of young children do

not facilitate children's engagement in developmentally stimulating activities that are beneficial for cognitive, physical and social development, then the children may develop a passive lifestyle with television viewing as a predominant activity in their daily routine.⁵⁵ Following this scenario, possible consequences of such behavior at young age could be poor social skills and problems with peers at later age. Two well-conducted population-based studies indicated that lengthy television exposure at young age is associated with bullying⁵⁶ and victimization⁵⁷ at school. These studies had few limitations; therefore, in order to address those limitations and to ascertain the association between preschool television exposure and bullying involvement in early elementary school, we studied whether television viewing time at age 2-5 years predicted bullying involvement in the first grades of elementary school. Additionally, we examined whether exposure to violent television content at age 5 years was associated with bullying. We observed the crude effects of the duration of television viewing on bullying involvement; however, these effects attenuated and became statistically not significant after adjustment for child and maternal covariates. Our findings show that children's high television exposure and bullying involvement are strongly related to such underlying factors as: maternal age, educational level, marital status and household income (as adjustment for these factors resulted in the strongest attenuation of the crude effects). Also, we found that exposure to violent television content at age 5 years was associated with the risk of being a bully at school. However, this exposure was not associated with the risk of being a victim or a bully-victim. Also, the direction of this cross-sectional relation is unclear as children who are bullying their peers may also have a stronger interest in viewing violent content on television. In sum, our findings suggest that social disadvantage, reflected in maternal socioeconomic factors (e.g. lower income, lower educational level) may represent the actual risk for both – a child's excessive television viewing at preschool age and bullying involvement in early elementary school.

METHODOLOGICAL CONSIDERATIONS

In the following section, a critical reflection upon some of the methodological issues is presented. These methodological considerations are first discussed in detail, and then, based on the obtained insights and knowledge, several recommendations for further research in the field are suggested.

Peer/self-reports of bullying involvement: a double-edged sword?

In the context of bullying involvement, which is widely acknowledged to be a group process,⁵⁸ the sociometric peer nomination method is decidedly one of the most suitable assessment methods. This method enables a researcher to summarize and quantify the (often elusive) group processes. Researchers studying peer relations agree that sociometric peer nomina-

tions provide a unique insight into peer relations in a group, and that this insight cannot be easily substituted by other sources of information.^{59,60} Its capacity to map how an individual perceives others and how others perceive the individual⁶¹ is one of the major strengths that we considered when selecting this sociometric method for assessment of peer relations in our studies.

This method enables researchers to assess bullying in the actual context of peer interactions: usually, a sociogram (i.e. a sociometric diagram) of the social network or the sociometric scores, derived from the peer nominations, are used to investigate interpersonal relations in the group.⁶¹ Once the ratings of all the peers in a class are aggregated using either of these approaches, it becomes easier to obtain a reliable and objective measure of bullying at a group level.

In our study (chapter 3), bullying scores of children were based on the peer nominations they received from their peers (i.e. the indegrees). The use of these so-called indegrees is likely to produce an objective measure of bullying, as explained above. In contrast, the victimization scores of children were based on their so-called outdegrees. Children reported by whom they were bullied. Nominations they gave-out when nominating their aggressors were used to calculate their victimization scores. Children were not asked to report whom they bullied. This was a conscious choice for two reasons. First, a victim him/herself is likely to know best whether he/she is victimized. A victim's perspective is important because: (a) reports of the peers can be influenced by their subjective view and interpretation of an event as victimizing or not (also, a victim's subjective perception of feeling victimized is core to the meaning of a victim⁶²), and (b) because victimization may remain undetected by peers, especially its covert forms (in contrast to the victims themselves, peers can be unaware of the secretive victimization incidents).⁶³ In addition, it may be difficult for young children to reflect upon the feelings of their victimized peers. Also, a study that compared the use of peer- and self-estimations of aggression and victimization in 8-year-old children, showed that at young age, children tend to under-report the victimization of their peers; whereas the peer reports of aggression tend to be more reliable than the self-reports of aggression (mainly due to the social desirability bias).¹⁷ Therefore, considering the subjective nature of bullying victimization (i.e. it is defined through the subjective perception of a victim experiencing the power imbalance), it is justified to uphold that children/victims themselves (rather than their peers) may be robust informants of victimization.⁶³

The second reason for assessing peer victimization using the outdegrees is efficiency and feasibility of the assessment. We aimed to keep the duration of the assessment under 10 minutes. The average time of the task completion was 7.6 minutes. Mirroring all the questions in order to enquire about the role of a child as a bully and then as a victim, would have doubled our total time. Also, we were concerned that such mirrored questions could be confusing to the youngest participants, as in case of such mirroring we would require a child to switch cognitively between the roles of a victim and a bully for each specific question.

We are unable to ascertain whether choosing the subjective report of victimization has compromised our measure. On the one hand, possibly yes – as the reports of peers would have provided us with an ‘independent’ perspective on victimization in a class. On the other hand, this perspective would reflect the attributed victimization, which varies in the eye of the viewer. Most likely, those reports of victimization would have generated lower rates of victimization as compared to the victims’ own perspective,¹⁷ possibly indicating an underestimation of the actual rates. In either way, we acknowledge the possibility of bias due to the subjectivity of victimization reports. However, behavioral science owns very few measurement methods that eliminate subjectivity at every stage of the assessment.

In light of its many merits,^{59,60} the peer nomination method is a valuable research technique. However, the peer nomination method is (certainly) not a flawless method. As advocated by Olweus, one of the ‘founders’ of research on bullying: the peer nomination method should not be considered a “gold standard”.⁶³ The major critique point is that it remains unclear whether this method is suitable for estimation of the prevalence of bullying involvement and for the study of change when a restricted number of nominations is used during peer nominations. Requiring children to report a specific and limited number of nominations (e.g. “nominate 3 children, who bully other children in your class”) impedes the possibility of examining the differences and changes between schools. Generally, for comparability reasons, either across populations or across time points, a standardized questionnaire may be more suitable; however, peer network questions with unlimited peer nominations also can be used for this purpose. Traditionally, most of the large-scale prevalence studies choose for a survey method.^{5,6,64} Similarly, we also used a population-based survey to study prevalence of bullying involvement in early elementary school (see chapter 2). Ultimately, this is a trade-off between obtaining that “unique insight into peer relations”, described above, and perhaps somewhat less precise but very efficient and cost-effective estimation of bullying behavior in a large sample. The important issue here is: what objective should a study serve? The use of a questionnaire is particularly functional when the interest of the study lies in a specific (temporal) frequency or in a comparison of such frequencies. From this perspective, the prevalence of bullying involvement obtained through the use of a standard survey is likely to be less arbitrary than the prevalence that can be obtained through the use of peer nominations.

In conclusion – luckily, there is no “gold standard” in bullying research, as depending on the aims and design of the study, the age of its participants, and the resources available to a researcher, one method may be more suitable than the other. Thus, we suggest that in spite of a rather low agreement between the reports of different informants on child behavioral problems,⁶⁵ when possible, *multiple informants and methods should be used* in order to maximize the reliability and validity of our estimates. This is especially worthwhile because different methods, such as self- and peer-reports, are likely to provide researchers with complementary information.⁶⁶

Bullying and aggression: importance of understanding the concept

Aggression is an umbrella term for any behavior (verbal or nonverbal) that is carried out with an intention to harm another person while that other person is motivated to avoid the hurtful actions.^{67,68} The intentionality and hurtfulness are also used as criteria for defining bullying behavior. According to the traditional and most widely accepted⁶⁹ definition of (school) bullying by Olweus,⁷⁰ it includes any direct or indirect acts of aggression that are intentional, repeated and involve power imbalance between a bully and a victim (i.e. a bully has greater psychological or physical strength and a victim finds it difficult to defend him/herself).⁶⁸ Bullying is a type of aggression, and thus these constructs are largely overlapping. The major “differences” between the concepts of aggression and bullying are the bullying criteria of its repetitiveness and power imbalance. Importantly, bullying is the term used exclusively to describe aggressive behavior among *peers* and only in relation to aggressive behavior occurring within a *group*. Thus, it is largely a group-specific type of aggression.

Even though there is a large consensus in the field of bullying research with regard to this “classic” definition of bullying,⁶⁹ its criteria may pose some challenges to researchers studying it. An example of one concern could be: do young children skillfully distinguish between a purposeful aggressive event and an unintentional one, or should this be explicitly explained to them? We argue for the latter. However, even when an explanation is provided, children may still differ in the extent to which they perceive an event as purposeful to hurt and to cause problems⁶². Also, in reference to the repeated nature of bullying, some researchers argue that a child who suffered one, but extremely distressing incident of peer abuse, would be likely to consider it bullying, whereas a researcher would “disagree” with that.⁶⁸ The power imbalance is *the* criterion of bullying.⁶² Yet, most researchers struggle with operationalization of this important criterion.⁶⁸ The main struggle is the operationalization of that subjective experience of feeling helpless and victimized. The important nuance is that the criterion of power imbalance has to be perceived by a child even though it can be reflected in a range of objective factors, such as physical strength or popularity.⁶² Therefore, when assessing bullying, it is strongly recommended to provide the respondents with a clear definition of bullying and to emphasize the three criteria that distinguish its specific nature.^{62,70}

Should the differentiation between bullying and aggression be seen as putting old wine in new bottles? Olweus argues that conceptually it is important to distinguish between bullying/victimization and general aggression/victimization.⁶² This claim is supported by the evidence that, from the perspective of a victim, experiencing the power imbalance during bullying is more distressful and hurtful than experiencing peer aggression otherwise.⁶² Thus, even though there may be a substantial overlap between bullies and the generally aggressive children, these groups of children are not identical.⁶²

In the context of our study of young children (chapter 3), we dealt with this concern by explaining to children the definition of bullying (i.e. the three criteria, examples of non-bullying behavior that could be mistaken for bullying), and by emphasizing in each bullying question

the intentionality of bully's behavior, its repeated nature and the difficulty of a victim to defend him/herself. The visual and audio components of the questions were designed to accentuate the weaker and disadvantaged position of a victim. Curiously, during the assessment, it was frequently observed by researchers that children expressed empathic (verbal) responses towards a portrayed victim. Even though it was not formally tested, yet it may indicate that our effort to portray the power imbalance hallmarking bullying was at least partly successful.

Focusing on early-age predictors of bullying involvement

Findings of several longitudinal studies provided convincing evidence for negative physical and mental health consequences of bullying and victimization,^{34,71-74} especially in the context of persistent bullying involvement.^{75,76} Primarily the victims and the bully-victims face the risks of severe psychiatric disorders in childhood and adulthood⁷¹. One well-conducted study showed that the effects of bullying victimization in childhood include such long-lasting consequences as increased rates of depression, anxiety disorders and suicidality, which are experienced by the individuals up to four decades after the exposure.^{73,77} Also bullies face negative consequences as a result of their behavior; although, the effects for bullies tend to be somewhat less severe as compared to the victims and the bully-victims. The common examples of the long-term outcomes of bullies are: antisocial personality disorder,⁷¹ delinquency and criminality.^{62,78,79} Taken together, there is no doubt that bullying involvement has negative consequences and it is an alarming public health problem.

Because of the described above negative consequences, it is important to predict and prevent the risk of bullying problems before they start going from bad to worse. Lifecourse epidemiology⁸⁰ may have a certain advantage with regard to this task. Large, prospective population-based studies of child development from early age onwards can be helpful in identifying (new) predictors of bullying involvement. However, as discussed later in this chapter, recent examples show this may be easier said than done.

An exceptional study, that reviewed and synthesized the recent findings on predictors of victimization, proposed that factors, which can be considered most promising in their capacity to predict bullying involvement are: child internalizing problems (e.g. withdrawal, anxiety-depression, unassertiveness) and externalizing problems (e.g. aggression).¹³ Also, a few environmental factors that are associated with victimization were suggested: family socioeconomic status, parental depression, domestic violence, child maltreatment, and school overcrowding).¹³

Whereas the effects of the mentioned above environmental predictors are both plausible and rather straightforward, the effects of child internalizing and externalizing problems in relation to bullying involvement are debatable, especially with regard to the direction of these effects. This is because such problem behaviors may, on the one hand, increase child vulnerability to bullying involvement, and on the other hand, these problems may be a consequence of bullying involvement as they often manifest in children who are already involved in

bullying. The possibility of such bidirectinality complicates the prospect of accurately predicting the outcome, especially when both the problem behavior and bullying involvement are studied simultaneously and at older ages.

Most of the research on school bullying is cross-sectional and correlational, which, in the end often leads to the question about the direction of the studied association. Another reason for this predicament is that prospective studies of young children, which could examine this issue, are largely lacking. Few attempts to determine the direction of the association in prospective studies of young children have been reported.^{81,82} For instance, in a study of Fekkes,⁸¹ the differences between the baseline and the end measure of a 6-month follow-up of school-children age 9-11 years, showed that the association can be bidirectional. Fekkes⁸¹ reported: children involved in bullying were more likely to develop new psychosocial problems, but at the same time, children with depression and anxiety symptoms were more likely to become victims. However, this finding was based on the 6-month follow-up of child self-reported exposure and outcome, which were not adjusted for any potential confounders besides the age and gender of the children (e.g. socioeconomic status is an example of an important potential confounder).⁸¹ Another prospective study suggested that being a victim or a bully-victim during the first years of schooling, uniquely contributes to behavioral problems and to school adjustment difficulties.⁸² Therefore, there is some evidence for the bidirectionality of the association, and the view that these effects may be bidirectional is becoming increasingly common.³³ Also, some evidence from a recent meta-analysis is pointing in this 'direction'.⁸³ Nevertheless, the importance of prospective longitudinal studies of young children in facilitating further understanding of these associations cannot be overemphasized.

To conclude, in the study presented in this thesis (chapter 5) we focused on early-age behavioral problems as predictors of bullying involvement. In our study, we observed the antecedent effect of preschool attention/deficit hyperactivity and oppositional defiant problems in relation to the risk of becoming a bully or a bully-victim at school. These effects were observed at young age (ages 1.5, 3 and 5 years), which suggests that these behavioral problems are possible antecedents of bullying in early elementary school. At the same time, our findings do not preclude the possibility of the bidirectional influences.

In pursuit of comprehensive understanding of bullying involvement: an epidemiologic wild-goose chase?

The overarching goal of this thesis was to obtain a richer understanding of bullying and its potential risk factors. However, focusing solely on the individual child characteristics as potential predictors of bullying involvement (e.g. chapters 5 and 6) is not sufficient for a comprehensive understanding of this problem. A comprehensive understanding of bullying requires a more complex investigation that reaches beyond that, especially because bullying is an interpersonal *relation* embedded in its *social context*. Therefore, one of the limitations of the studies presented in this thesis is its narrow focus on a child him/herself as a participant of bullying

processes. A failure to include the joined influences of (a) the interdependent and dynamic *relationship* between a bully and a victim, and (b) the *social context* in which the interactions between a bully and a victim are embedded,⁸⁴ is destined to limit the results of the study, drawing an incomplete picture of the studied problem. The importance of this issue and the challenges of addressing it are discussed next.

Relationship between a bully and a victim

Many researchers, teachers and parents share the view that a better understanding of the causes of bullying victimization will help to understand why some children become victims of bullying whereas others do not. Several important individual and contextual risk factors of bullying and victimization have been identified in the past decades of research.⁸⁵ For instance, as suggested in a meta-analysis that synthesized various risk factors of bullying involvement, rated on the basis of the largest effect size, the most influential characteristics predicting the risk of victimization are: a child's low peer status, social incompetence, and internalizing problems.⁸⁵ In contrast to this, the most influential characteristics predicting the risk of becoming a bully are: externalizing problems, bully's cognitions and the peer influences.⁸⁵ This demonstrates that both individual and contextual factors can substantially increase a child's risk of bullying involvement. However, the individual characteristics of a child can predict the risk of bullying victimization only to a certain extent if the influences of the child's dyadic relationships and social context are not considered. Yet, the studies of contextual influences are rather uncommon, and most of the studies that examined bullying problems traditionally focused on child individual characteristics as predictors of bullying involvement.⁸⁵

Studying a bully and a victim separately from one another and in isolation from the influences of their social context provides a limited, one-sided, understanding of the bullying problems. In his book on the developmental origins of aggressive behavior, Tremblay⁶⁷ raised an interesting issue: "why do most studies focus on 'What makes a bully?' or 'What makes a victim?' rather than focusing on the relationship between a bully and a victim?" There is no bully without a victim and there is no victim without a bully; and the relationship between a bully and a victim is likely to contain valuable information about the mechanisms that maintain these social roles. Similarly, Pierce and Cohen⁸⁴ emphasized the importance of studying the relationship between a bully and a victim. This relationship is argued to be dynamic, because both the bully and the victim are likely to influence one another through their characteristics and through their behavior, and their relationship is likely to develop or change over time.⁸⁴ Importantly, every dyadic relation heavily depends on the characteristics, perceptions and behavior of the children in that dyad. Therefore, studying each dyad as a unit of analysis together with the characteristics of that dyadic relationship is likely to improve our understanding of the dynamic relationships between a bully and a victim. Luckily, the recognition of the importance of this issue is increasing, and more studies are examining the dynamics of the

bully – victim relationship,^{86,87} rather than studying solely the individual characteristics of a bully or a victim.

Social context

A bully – victim relationship occurs in a social context and such relationship should be studied and understood in reference to its social context.⁸⁸ This is because the status of a bully is established in relation to the social context in which the bullying occurs. The role of the group is central as the status of the bully is ‘assigned’ by the group in which these interactions take place, and this status exists only in relation to other members of this group. Similarly, the status of a victim (who is usually rejected by peers), is also established relative to the rest of the children in the peer group. Moreover, the way in which the group members perceive the interactions between a bully and a victim is likely to influence the relationship of the children in the bully – victim dyad. In fact, the characteristics and behavior of children in the group are likely to moderate the bullying and victimization.⁸⁸

Therefore, bullying and victimization are a result of the joint influences of the individual characteristics of children, the dynamics of the bully – victim relationships, and the specific social context of these relationships.⁸⁵ However, social context can be very complex. For instance, a peer group can contain multiple subgroups of children, who tend to ‘cluster’ together; and children in a group may form multiple dyads with one another⁸⁶, and the relationships in these dyads can be positive or negative. Also, children can take on multiple social roles depending on the composition of a dyad and the circumstances. Similarly, in reference to bullying, same child may take on different roles in different situations (e.g. a bully or a defender). Importantly, a comprehensive understanding of bullying requires studying multiple factors, including the complex contextual influences. Pierce and Cohen⁸⁴ described a contextual framework for examining a relationship between a bully and a victim. According to this approach, a *social context* of peer interactions has to be examined in four main facets: (1) the individual characteristics of all the children in a peer group (e.g. their behavior, social information processing), (2) the reciprocal social influences of different social systems (e.g. influence of the peer group, the ingroup, family, community), (3) the constraints and opportunities of the physical settings (e.g. classroom, playground, neighborhood), and (4) the dynamics and reciprocal influences between these three facets over time (e.g. victims become more disliked by their peers over time).⁸⁴ Also, Pierce and Cohen⁸⁴ pointed out that, besides identifying the influences of the different social contexts on a bully or a victim, it is important to consider the perceptions and evaluations of these influences by a bully and a victim. Hence, it is argued that researchers need to examine the joined and reciprocal influences of child individual characteristics, the dynamics of the relationships in the bully – victim dyads and their complex social contexts (both proximal and more distal ones). Examining only child individual characteristics, without considering the dyadic relationships and the relevant contextual effects, is likely to halt our pursuit of the comprehensive understanding of causal processes.

Challenges in understanding of causality

A researcher studying individual early-life predictors of bullying victimization is limited in the prospect of understanding the causes of bullying involvement. This is because the research that neglects the social context of bullying victimization is likely to generate a “personalized” bias, both with regard to the etiology and the consequences of bullying.⁸⁵

However, studying the joined and reciprocal influences of individual characteristics, the bully – victim relationships and the proximal and distal social contexts poses some challenges. First, assessing and analyzing the dynamic peer interactions and the complex social circumstances, under which these interactions occur, requires an application of more sophisticated measures and research designs. Importantly, some significant advances have recently been made in an attempt of understanding the dynamics of the relationships in a social network.^{87,89} Second, given the complexity of social contexts, the researchers may need to alter their expectations with regard to the extent to which they can understand the causes of bullying victimization. This is because identifying important individual risk factors of victimization on a group level will not necessarily reveal why one child is victimized and another is not, especially if the dynamic influences of the complex social contexts are not considered.

An important issue here is that part of the cause may not always be measurable or even identifiable. In his John Snow Lecture on the gloomy prospects of epidemiology, Davey Smith suggested that our search for *the* ultimate missing cause of an outcome resembles a “wild-goose chase”.⁹⁰ Earlier, a similar line of thought was expressed in work of Plomin,⁹¹ and later, also in work of e.g. Coggon and Martyn.⁹² Davey Smith argues that: “largely chance events contribute an important stochastic element to disease risk that is not epidemiologically tractable at the individual level”.⁹⁰ He explains that chance events make up an important and large composite of a risk attributed to a certain cause. The prospects of discovering new risk factors are “gloomy”, in his view, because thus far this approach has not been highly successful. For instance, in cancer studies of twins/adoptees, both heritable and shared-environmental influences are substantially smaller than the lion share of variance in the risk of developing a disease that is attributed to the non-shared environmental factors (i.e. factors that are not correlated between people raised in the same family).⁹⁰ Plomin⁹¹ provided some examples of the categories of such non-shared environmental influences: child peer groups, television, accidents and many more. In reference to this issue, Davey Smith makes an important point: “exposures contributing to non-shared environmental influences are often unsystematic and of a time- or context-dependent nature”.⁹⁰ In other words, many crucial, influential factors of the risks we are studying are time- and context-specific.

Similarly, in an essay on stochastic nature of disease causation (and on the role of *time* and *chance* in it), Coggon and Martyn⁹² argue that researchers studying causes of diseases largely underappreciate the role of stochastic processes. To educate us, the authors advise to distinguish between the necessary and sufficient causes.⁹² Not being exposed to a necessary cause may explain why one person does not develop a certain disorder, whereas the presence

and exposure to the sufficient cause(s) can explain why another person does develop the disorder.⁹² However, Coggon and Martyn⁹² emphasize that, almost always, most of the known causes are neither necessary nor sufficient, and thus these causes alone cannot explain why one person does get ill and another does not. These causes can provide information about why the disease is more common in one group than in another, however this has limitations to the extent we can understand the risks of the individuals in those groups. Thus, understanding why one person develops a certain disorder, whereas the other person does not, “involves not only the identification of the necessary and sufficient causes but importantly – the *circumstances* in which they apply”.⁹² Unfortunately, these circumstances are largely stochastic. Identifying these circumstances, and let alone predicting them, may be like the “wild-goose chasing”.⁹⁰ In the context of bullying victimization: having a highly aggressive bully-classmate can be considered a necessary cause of victimization; and being somewhat withdrawn and shy can be seen as another important, and perhaps necessary, cause. However, not all withdrawn and shy children are victimized and not all victimized children are withdrawn and shy. Identifying the necessary and sufficient causes and *the circumstances* in which they operate may explain what suffices the occurrence of bullying victimization. However, considering the group-nature of bullying and various factors that can influence the characteristics and behavior of every child in a group, we are practically destined to miss the sufficient cause, as the *circumstances* that steer most of the individual outcomes are largely situational, and thus, at least to some extent stochastically determined. As described earlier in this section, the role of social *contexts* is particularly important in bullying processes. Therefore, some aspects of the risk of bullying victimization may also be context-specific.

Importantly, in causal processes of some outcomes the role of stochastic processes may be larger than in the causal processes of other outcomes. Consider a genetic disorder, such as Huntington’s disease (mono-genetic) or macular degeneration (complex genetic). Our current understanding of the causes of these disorders is extensive and the predictive ability, based on the individual genetic heritability, is fairly high. However, the sufficient causes of many other disorders remain mostly unidentifiable, and the identified necessary causes seldom predict the occurrence of a disorder for the majority of the individuals.⁹² Even in case of smoking, which has been identified to be an important cause of lung cancer, “epidemiologists do a rather poor job of predicting who is and who is not going to develop a disease”.⁹⁰ In the context of bullying involvement the matters are complicated even further because the outcome we are studying is an *interpersonal behavior*, something what inherently is even more difficult to predict than a disease.

Nevertheless, many important individual and contextual risk factors for bullying involvement have been identified.⁸⁵ Therefore, it can be concluded that, even though we may be unable “to discipline the random nature of the world”⁹⁰, we should aim for a comprehensive understanding of bullying problems by finding a way to study the interplay between the individual risk factors, the dynamics of the bully – victim relationships and the complex influences

of the social contexts. Certainly, it may be difficult or virtually impossible to ever achieve a complete understanding of causation, especially when studying an interpersonal behavior such as bullying victimization. Inevitably, this has implications for the extent to which we can predict the risks for individual children. However, there is no need for indignation, because what we can do is focus on the factors that predict large effects and that can be modified through multifaceted prevention and intervention efforts.

PRACTICAL IMPLICATIONS

In light of the findings presented in this thesis, several suggestions for prevention and for future research are proposed next. The rates of bullying and victimization (chapter 2), i.e. about a third of children are involved in bullying as a bully, victim or a bully-victim, suggest that systematic and effective prevention efforts may be necessary already in early elementary school. Many research-based prevention and intervention programs are available to public health professionals and researchers.^{11,70,93,94} Systematic and continuous use of the appropriate and effective measures requires expertise and resources. Understandably, most schools can benefit from professional assistance and guidance in this process.

Children from socioeconomically disadvantaged families may be more vulnerable to bullying involvement (chapter 2). By definition, all individuals in a group should to be targeted by prevention efforts because bullying is a social problem tied into the group processes. However, awareness of this increased vulnerability is important as these children may require extra attention and care. This is because these children, besides their risk of bullying involvement, are likely to have other co-occurring problems, which also often stem from their socioeconomic disadvantage.^{95,96}

The findings presented in chapter 5 suggest that early-manifesting behavioral problems (i.e. attention deficit/hyperactivity and oppositional defiant problems) can increase children's vulnerability to subsequent bullying involvement. This suggests that at school entry, parents and teachers should consider preventive measures to reduce children's risk of peer problems. Different methods of management of such behavioral problems are available to parents and teachers.^{43,97-100} Our finding that children with low/decreasing behavioral problems at preschool age did not face an increased risk of bullying involvement, suggests that timely interventions may be helpful in preventing later bullying involvement. Appropriate and effective management of children's behavioral problems at young age may make these children's adjustment at school less problematic and may help improve their peer relations.

The findings presented in chapter 6 suggest a relation between children's executive functioning (inhibition problems, working memory problems) and bullying involvement at school. These findings indicate that young children at risk of peer problems may benefit from social-cognitive trainings. Because executive function governs planned and intentional behaviors,

training inhibition and working memory may enhance social and problem-solving skills of children, as well as their behavioral control. Such an approach may be helpful in building children's resilience to peer problems.¹⁰¹

The results presented in chapter 7 demonstrate that, in comparison to children with normal weight, overweight/obese children are more likely to bully others and to be victimized by their peers. Recommendations for targeted bullying interventions may be premature because the exact mechanism explaining the association between overweight and bullying involvement needs to be identified, and the potential protective factors (e.g. strong social skills) do not seem to reduce the risk of bullying involvement among obese children.⁵² Nevertheless, the negative outcomes of bullying involvement emphasize the need for effective (universal) interventions directed at bullying prevention. Similarly, the high prevalence of overweight/obesity among young children, and the known physical health and psychosocial consequences of obesity^{53,102}, call for effective interventions addressing obesity problems. The social stigma that overweight/obese children face may be an important factor contributing to bullying involvement among these children and thus, effective stigma-reduction interventions need to be considered.⁵³

Finally, the findings presented in chapters 8 and 9 suggest that excessive television viewing may have negative effects on children's behavior. As suggested in the guidelines of the American Academy of Pediatrics¹⁰³, parents of preschool children, particularly toddlers at age 2 years or younger, are advised to limit children's exposure to television. At young age, cognitively and physically stimulating activities, as well as social play with peers, have greater benefits for children's development. However, in contrast to the passive television viewing, a sensible and restricted use of interactive media (e.g. the use of age-appropriate and interactive apps) by young children is permissible.¹⁰⁴

Looking into the future

Longitudinal birth cohorts, such as the Generation R Study, can help researchers find some of the important clues to resolve the pressing etiologic questions. When analyzing the ingredients of successful longitudinal studies, Moffitt suggested that "horizon scanning" is one of the secrets of a study's success.¹⁰⁵ This means looking several years into the future and anticipating trends and developments in research, technology and techniques that can be applied in the study.¹⁰⁵ Such 'horizon scanning' exercise in reference to the studies presented in this thesis, suggests that imaging and epigenetics could be promising research directions that may offer us new interesting insights. For instance, the associations we observed between such factors as attention/deficit hyperactivity problems, executive function and IQ with bullying involvement, covertly point to the neurocognitive origins of peer aggression. Future studies could examine the role of early cognitive development in bullying and victimization. Tremblay suggested: "children appear not to be learning to use physical aggression as they grow older; rather they appear to be learning not to use physical aggression."⁶⁷ Certain developmental

problems seem to prevent children from learning socially acceptable behaviors, which could be one of the reasons of their bullying involvement at school. Perhaps, neuroimaging studies will soon be able to provide new insights about possible cognitive causes of bullying. For instance, some recent findings from functional magnetic resonance imaging indicated that, the structure of the striatum and right anterior cingulate cortex are associated with (impulsive) aggression in young children.¹⁰⁶ Also, some earlier accumulated evidence suggests that, differences in prefrontal cortical development or a failure of the anterior cingulate cortex can be important clues in understanding bullying involvement.¹⁰⁷ Similarly, studies of gene-environment interplay can generate interesting findings. Recent research advocates the importance of the genetic influences in antisocial behaviors¹⁰⁸ and in bullying involvement.^{109,110} Lately, genetic epidemiologists have moved away from the (statistical) gene-environment interaction studies on to epigenetic studies, as they learned its potential of identifying the actual physiological influence of environment on a gene. Emerging evidence in this field suggests that, differences in methylation profiles between aggressive and nonaggressive individuals can be identified.¹¹¹ In the near future, studies will reveal if epigenetics can provide us with a better understanding of aggression problems and their prevention.

On the crossroad of the disciplines

The studies that are presented in this thesis are a product of knowledge and methods coming from different sites and fields - epidemiology, psychiatry, public health and sociology. These studies are the result of a cross-disciplinary collaboration between researchers from different fields. Such collaboration across the research fields facilitates the use of the expertise of each discipline. Yet, only if we manage to truly collaborate, that is to utilize the best of what each discipline has to offer, can we advance the field of bullying research further.

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SUMMARY IN ENGLISH

As outlined in chapter 1, school bullying negatively affects the development and health of children. The importance of effective preventive efforts starting early in school curriculum is widely recognized. However, relatively little is known about the extent of bullying problems in early elementary school and about the vulnerability of young children to bullying and victimization. Studies among young children are uncommon as most of the research is carried out among the (pre)adolescents. Therefore, the objective of this thesis was to examine children's bullying involvement in early elementary school. In the population-based studies presented in this thesis, we assessed the prevalence of bullying involvement and the socioeconomic and demographic characteristics of children who are affected by bullying. Furthermore, we examined early-age risk factors associated with bullying and victimization in elementary school.

As described in chapter 2, on average about a third of young elementary school children were reported to be involved in bullying either as a bully, victim or bully-victim (i.e. both bullying others and being victimized). Boys were more often engaged in bullying either as bullies or bully-victims. However, both boys and girls were equally likely to be victimized. Furthermore, boys were more frequently involved in overt types of bullying (i.e. physical or verbal), whereas girls engaged more in relational bullying (i.e. social exclusion). Also, the findings presented in this chapter showed that there are some socioeconomic disparities in children's involvement in school bullying. Examining the characteristics of the bullies, victims and bully-victims demonstrated that children from families with lower socioeconomic status or children attending schools in lower socioeconomic neighborhoods were at more risk of becoming a bully or a bully-victim. Parental educational level was the only socioeconomic characteristic that was associated with an increased risk of becoming a victim. Importantly, once the effect of the family socioeconomic status was accounted for, the risk of bullying involvement that was associated with the socioeconomic status of the school neighborhood was reduced and was no longer statistically significant. The latter finding suggests that at young age family socioeconomic status may be more salient to the risk of bullying involvement than the socioeconomic status of the neighborhood.

In chapter 3, we described the use and the psychometric characteristics of the PEERS Measure, a computerized peer nomination instrument that allows young children to report about their relations with peers and about bullying problems in their class. The results demonstrated good test-retest reliability, and the data were congruent with the earlier-reported patterns in children's peer relations (e.g. a strong correlation between bullying and peer rejection). Also, the observed socio-demographic differences among children involved in bullying were similar to the differences reported in earlier studies (e.g. more bullying among ethnic-minority children and among children of mothers with lower educational levels). The correlations of peer-reported bullying with aggressive behavior reported by a child him- or herself or by

a teacher were in the expected range. The findings of this study allowed us to conclude that the PEERS Measure is a reliable and age-appropriate instrument, which can be used to collect dyadic/network data about children's peer relations as early as in the first grades of elementary school.

Sex differences in bullying, victimization, defending and in peer acceptance and rejection were examined in chapter 4 of this thesis. Same-sex and other-sex dyadic relations were studied. The results of this study showed that boys were more often nominated as bullies. Both boy and girls were more likely to nominate same-sex peers when answering questions about peer acceptance. Also, children were more likely to nominate their defenders in the questions about peer acceptance, and this was regardless of whether the victim-defender dyad was a same- or other-sex relation. The peer acceptance from the other-sex classmates was higher for those children, who defended other-sex peers. Bullies, who victimized boys, were more likely to be rejected by boys. Similarly, if the bullies victimized girls, then these bullies were more likely to be rejected by girls. Sex differences were also observed in the peer rejection of the victims. The victims of male bullies were more rejected by other boys, whereas the victims of female bullies were more rejected by other girls. Altogether, these findings demonstrate that there are sex-dependent patterns in peer relations at young age, and many of them are similar to the patterns observed among older children.

The aim of the study presented in chapter 5 was to examine whether early-age behavioral problems, namely attention/deficit hyperactivity or oppositional defiant problems, are possible antecedents of bullying problem at school. Our results showed that children with higher behavioral problem scores at age 3 years or at age 5 years had an increased risk of becoming a bully or a bully-victim in the first grades of elementary school. Furthermore, we showed that children, whose behavioral problems levels were higher or increased throughout preschool age, were at more risk of becoming a bully or a bully-victim at school, as compared to the children, whose behavioral problem remained low or decreased before school entry. Altogether, our findings indicated that early-age behavioral problems can predispose children to bullying involvement at school.

In chapter 6, the association of child executive function and non-verbal intelligence with bullying involvement was studied. The findings of the study showed that poor inhibition was associated with both the risk of bullying and the risk of victimization. The effect was most pronounced in the groups of bullies and bully-victims. Also, children with working memory problems had an elevated risk of becoming a bully. However, the statistical significance of the latter finding was only marginal. Finally, child non-verbal IQ had a protective effect in relation to the risk of bullying involvement. Children with higher non-verbal IQ were less often involved in bullying as a victim or a bully-victim. Overall, our findings suggest that executive function problems, marked by poor inhibition and poor working memory, and a lower non-verbal IQ are associated with a risk of bullying involvement at school.

The results of the study presented in chapter 7 showed that a higher body mass index of a child was associated with an increased risk of bullying and victimization at school. The comparison of boys and girls showed that the risk of bullying was present predominantly among boys and primarily in reference to physical forms of bullying others. Furthermore, our findings across the specific bullying involvement roles showed that, in comparison to the normal-weight peers, obese children were more frequently involved in bullying as bully-victims, rather than merely as bullies or victims. Altogether, our study suggests that higher body mass index may increase children's vulnerability to bullying and victimization. Future studies should examine the mechanisms which instigate the association of BMI with bullying problems.

Chapters 8 and 9 present the findings of the studies in which we examined the effects of the time span of television exposure at young age on behavioral problems and on bullying involvement at school. The results presented in chapter 8 demonstrate that (sustained) high television exposure at 24 and 36 months was associated with the incidence of externalizing problems and with the persistence of the pre-existing externalizing problems at 36 months. In chapter 9, we examined whether television exposure patterns throughout preschool age increase a child's risk of bullying involvement at school. In this study, we observed the crude effects of the duration of television viewing on bullying involvement; however, these effects attenuated and became statistically not significant once they were adjusted for child and maternal covariates. Our findings show that children's high television exposure and bullying involvement are strongly related to such underlying factors as: maternal age, educational level, marital status and household income (as adjustment for these factors resulted in the strongest attenuation of the crude effects). Also, we found that exposure to violent television content at age 5 years was associated with the risk of being a bully at school. However, this exposure was not associated with the risk of being a victim or a bully-victim. Also, the direction of this cross-sectional relation is unclear as children who are bullying their peers may also have a stronger preference for viewing violent content on television. In sum, our findings suggest that social disadvantage, which is reflected in maternal socioeconomic factors (e.g. lower income, lower educational level), may represent the actual risk for both – a child's excessive television viewing at preschool age and bullying involvement in early elementary school.

In the final part of this thesis, chapter 10, the main findings of the studies and several methodological and practical implications are discussed.

SUMMARY IN DUTCH / SAMENVATTING

Zoals beschreven in hoofdstuk 1 heeft pesten op school een negatieve invloed op de ontwikkeling en gezondheid van kinderen. Het belang van effectieve preventieve interventies vroeg in het schoolprogramma wordt door velen erkend. Tegelijkertijd is er echter relatief weinig bekend over de mate van pestproblemen aan het begin van de lagere school en over welke kinderen het meest kwetsbaar zijn voor pestproblemen. Studies bij jonge kinderen zijn zeldzaam, omdat de meeste studies worden uitgevoerd onder (pre)adolescenten. Het doel van dit proefschrift was daarom om de betrokkenheid bij pestgedrag van kinderen in de basisschoolleeftijd te onderzoeken. In de studies onder de algemene bevolking die in dit proefschrift worden beschreven, hebben we de prevalentie van betrokkenheid bij pesten en de sociaaleconomische en demografische kenmerken van kinderen die betrokken zijn bij pesten, bestudeerd. Verder hebben we risicofactoren op jonge leeftijd onderzocht die verband hebben met pesten op de basisschool.

Zoals beschreven in hoofdstuk 2 is gemiddeld een derde van de jonge basisschoolkinderen betrokken bij pesten, ofwel als pester/dader, als slachtoffer of als zowel dader als slachtoffer. Jongens waren vaker betrokken bij pesten, als daders of zowel dader als slachtoffer. Echter, jongens waren even kwetsbaar om slachtoffer te worden als meisjes. Daarnaast waren jongens vaker betrokken bij directe vormen van pesten (d.w.z. fysiek of verbaal pesten), terwijl meisjes zich meer bezig hielden met relationeel pesten (d.w.z. sociaal buitensluiten). Uit de bevindingen in dit hoofdstuk is ook gebleken dat er een aantal sociaaleconomische verschillen in de betrokkenheid van jonge kinderen bij schoolpesten zijn. Het onderzoeken naar kenmerken van daders, slachtoffers en kinderen die zowel dader als slachtoffer zijn, heeft aangetoond dat kinderen uit gezinnen met een lagere sociaaleconomische status of kinderen die naar scholen in de lagere sociaaleconomische buurten gaan, een hoger risico hadden om een dader of zowel dader als slachtoffer te worden. Ouderlijk opleidingsniveau was het enige sociaaleconomische kenmerk dat werd geassocieerd met een verhoogd risico om slachtoffer te worden. Belangrijk is dat zodra het effect van de sociaaleconomische status van het gezin werd meegenomen in de analyse voor het risico op betrokkenheid bij pesten, het verband tussen de sociaaleconomische status van de schoolomgeving aanzienlijk verlaagd werd en statistisch niet meer significant was. Deze laatste bevinding suggereert dat de sociaaleconomische status van het gezin op jonge leeftijd een belangrijkere risicofactor van betrokkenheid bij pesten is dan de sociaaleconomische status van de buurt.

In hoofdstuk 3 beschrijven we het gebruik en de psychometrische eigenschappen van de PEERS methode, een gecomputeriseerd instrument waarmee jonge kinderen kunnen rapporteren over hun relaties met leeftijdsgenoten en over pestproblemen in hun klas. De resultaten toonden een goede test-hertest betrouwbaarheid aan, bovendien stemden de gegevens

overeen met eerder gerapporteerde patronen in de relaties van kinderen met hun leeftijdsgenoten (bv. een sterke correlatie tussen pesten en afgewezen zijn door leeftijdsgenoten). Ook de socio-demografische verschillen tussen kinderen die betrokken zijn bij pesten, waren vergelijkbaar met de verschillen die gevonden werden in eerdere studies (bv. meer pesten onder allochtone kinderen en bij kinderen van moeders met een lager opleidingsniveau). Verder waren correlaties tussen pestgedrag -gerapporteerd met de PEERS methode- en agressief gedrag -gerapporteerd door leerkrachten of door kinderen zelf- in de verwachte orde van grootte. Naar de aanleiding van de bevindingen van deze studie konden we concluderen dat de PEERS methode een betrouwbaar en leeftijdsspassend instrument is, dat gebruikt kan worden om dyadische gegevens over relaties met leeftijdsgenoten te verzamelen in de eerste jaren van de lagere school.

Sekseverschillen in pesten, slachtofferschap, het verdedigen van en het geaccepteerd of afgewezen worden door leeftijdsgenoten hebben we in hoofdstuk 4 van dit proefschrift onderzocht. Dyadische relaties tussen kinderen van hetzelfde geslacht (jongen-jongen of meisje-meisje) en tussen kinderen van het andere geslacht (jongen-meisje) werden bestudeerd. De resultaten van deze studie toonde aan dat jongens over het algemeen vaker genoemd werden als daders door hun leeftijdsgenoten. Bij het beantwoorden van vragen over acceptatie door leeftijdsgenoten noemden zowel jongens als meisjes vaker leeftijdsgenoten van hetzelfde geslacht. Ook noemden kinderen vaker hun verdedigers in de vragen over acceptatie door leeftijdsgenoten, ongeacht of de verdediger van hetzelfde of het andere geslacht was. Ook werden kinderen die klasgenoten van het andere geslacht verdedigden meer geaccepteerd door hun leeftijdsgenoten van het andere geslacht. Daders die jongens pestten werden vaker door jongens afgewezen. Op dezelfde manier werden daders vaker door meisjes afgewezen, als de slachtoffers van deze daders meisjes waren. Sekseverschillen werden ook gezien in het afwijzen van slachtoffers. De slachtoffers van de mannelijke daders werden meer afgewezen door andere jongens in de klas, terwijl de slachtoffers van vrouwelijke daders meer werden afgewezen door andere meisjes. Samengenomen tonen deze bevindingen aan dat er al op jonge leeftijd sekse-afhankelijke patronen in relaties met leeftijdsgenoten bestaan en dat veel van deze patronen vergelijkbaar zijn met bekende patronen bij oudere kinderen.

Het doel van de studie die beschreven is in hoofdstuk 5 was om te onderzoeken of gedragsproblemen op jonge leeftijd, zoals hyperactiviteit- en aandachtsproblemen of oppositioneel opstandig gedrag, antecedenten van pestproblemen op school kunnen zijn. Onze resultaten toonden aan dat kinderen met hogere scores voor gedragsproblemen op de leeftijd van 3 jaar of 5 jaar, een verhoogd risico hadden om een dader of om zowel dader als slachtoffer te zijn in de eerste jaren van de lagere school. Verder hebben we laten zien dat kinderen met meer gedragsproblemen of van wie de gedragsproblemen toenamen in de voorschoolse periode, een hoger risico hadden om een dader of zowel dader als slachtoffer te worden op school

dan kinderen met minder gedragsproblemen of waarvan de problemen afgenomen waren voordat ze aan de basisschool begonnen. Onze bevindingen geven aan dat gedragsproblemen op jonge leeftijd kinderen vatbaar kunnen maken voor betrokkenheid bij pesten op de basisschool.

In hoofdstuk 6 werd het verband tussen het executief functioneren en de niet-verbale intelligentie van kinderen en betrokkenheid bij pesten bestudeerd. De bevindingen van de studie toonden aan dat slechte inhibitie geassocieerd was met zowel het risico op pesten als het risico op slachtofferschap. Het effect was het meest uitgesproken voor daders en voor kinderen die zowel dader als slachtoffer waren. Kinderen met werkgeheugen problemen hadden ook een verhoogd risico om een dader te worden. Echter, de statistische significantie van deze bevinding was marginaal. Het niet-verbale IQ van het kind had een beschermend effect op het risico betrokken te zijn bij pestproblemen. Kinderen met een hoger niet-verbaal IQ waren minder vaak betrokken bij pesten dan slachtoffers of kinderen die zowel dader als slachtoffer waren. Over het algemeen suggereren onze bevindingen dat het executief functioneren, gekenmerkt door een slechte inhibitie en slecht werkgeheugen, en een lager non-verbaal IQ geassocieerd zijn met een risico op betrokkenheid bij pesten op school.

De resultaten van de studie in hoofdstuk 7 laten zien dat een hogere body mass index van een kind geassocieerd was met een verhoogd risico op pesten. Uit de vergelijking van jongens en meisjes bleek dat het risico op pesten voornamelijk aanwezig was bij jongens en met name met betrekking tot fysieke vormen van pesten. Bovendien bleek dat, in vergelijking met kinderen met een normaal gewicht, zwaardere kinderen vaker betrokken waren bij pesten als zowel dader als slachtoffer, in plaats van alleen als dader of slachtoffer. Al met al suggereert onze studie dat een hogere body mass index de kwetsbaarheid van kinderen om betrokken te zijn bij pesten kan doen toenemen. Toekomstige studies zouden de mechanismen die het verband tussen BMI en pestproblemen aanzetten, moeten onderzoeken.

Hoofdstukken 8 en 9 presenteren de bevindingen van studies waarin we de effecten onderzocht hebben van de duur van televisieblootstelling op jonge leeftijd op gedragsproblemen en op betrokkenheid bij pesten op school. De resultaten beschreven in hoofdstuk 8 tonen aan dat lange televisieblootstelling op de leeftijd van 24 en 36 maanden, geassocieerd was met nieuwe gevallen van externaliserende gedragsproblemen en met het aanhouden van reeds bestaande externaliserende problemen. In hoofdstuk 9 hebben we onderzocht of patronen van televisieblootstelling op de voorschoolse leeftijd het risico verhogen op betrokkenheid bij pesten op school. In deze studie hebben we eerst ongecorrigeerde effecten bestudeerd van de duur van televisiekijken op betrokkenheid bij pesten. Echter, zodra deze effecten gecorrigeerd werden voor kenmerken van kinderen en moeders, nam de sterkte van deze effecten af en waren ze niet langer statistisch significant. Onze bevindingen tonen aan dat een hoge

mate van blootstelling aan televisie en betrokkenheid bij pesten voornamelijk samenhangen met onderliggende maternale factoren zoals de leeftijd van moeder, opleidingsniveau van moeder, burgerlijke staat en het inkomen van het huishouden. Ook vonden we dat de blootstelling aan gewelddadige televisieprogramma's op de leeftijd van 5 jaar geassocieerd was met het risico om een dader te worden. Echter, deze blootstelling was niet geassocieerd met het risico om een slachtoffer of om zowel dader als slachtoffer te worden. Ook de richting van deze cross-sectionele relatie is onduidelijk omdat kinderen die pesten ook een sterkere voorkeur kunnen hebben voor het bekijken van gewelddadige programma's op televisie. Kortom, onze bevindingen suggereren dat sociale achterstand, hetgeen tot uiting komt in maternale sociaaleconomische factoren (zoals een lager inkomen, een lager opleidingsniveau), de feitelijke risico factor is voor zowel overmatig televisie kijken op jonge leeftijd als voor de betrokkenheid bij pesten aan het begin van de lagere school.

In het laatste deel van dit proefschrift, hoofdstuk 10, worden de belangrijkste bevindingen van de studie en een aantal methodologische en praktische implicaties besproken.

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CURRICULUM VITAE

Marina Verlinden-Bondaruk was born on September 8th 1983, in Rivne, Ukraine. After graduating from the Rivne Gymnasium in the summer of 2000, she commenced studying at the National University of Kyiv-Mohyla Academy, Kyiv, Ukraine. After successfully completing the first year of the Bachelor program in Social Sciences and Social Technologies, she moved to London, UK, where she lived, worked and studied for three years. In 2004 she returned to Ukraine and in 2007 she graduated from the Bachelor program in Social Sciences and Social Technologies at the National University of Kyiv-Mohyla Academy in Kyiv. Parallel to her studies Marina worked at a non-governmental organization managing and implementing health promotion projects in the area of HIV/AIDS prevention. During 2006-2007 she worked as a research consultant at the Health Policy Initiative project of the US Futures Group USAID in Kyiv, Ukraine. At USAID she conducted a research project focusing on HIV/AIDS-related stigma amongst health care providers. Upon the completion of her Bachelor degree in 2007 Marina obtained a full scholarship to finance her Master's study in Public Health Education and Promotion at Maastricht University, the Netherlands. Upon the completion of this Master's program she joined the Department of Child and Adolescent Psychiatry/Psychology and the Generation R Study Group at the Erasmus Medical Center in Rotterdam, the Netherlands. Here Marina initiated her research training and commenced work simultaneously on her second Master's degree and her PhD thesis. In 2011 she graduated from the Master's program in Epidemiology and in 2014 Marina completed her Doctoral research.

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- Principles of Research in Medicine	2009-2011	0.7
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- Cohort Studies	2009-2011	0.7
- Case-control Studies	2009-2011	0.7
- Introduction to Public Health	2009-2011	0.7
- Methods of Health Services Research	2009-2011	0.7
- Primary and Secondary Prevention Research	2009-2011	0.7
- Social Epidemiology	2009-2011	0.7
- Study Design	2009-2011	4.3
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- Methodological Topics in Epidemiological Research	2009-2011	1.4
- Modern Statistical Methods	2009-2011	4.3
- Public Health Research Methods: Analysis of Population Health	2009-2011	1.9
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- Maternal and Child Health	2009-2011	0.9
- From Problem to Solution in Public Health	2009-2011	1.1
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Seminars, Workshops and Symposia

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Symposium: 40 Years Epidemiology, Rotterdam	2009	0.3
Generation R Study Symposium: Imaging and Early Brain Development, Rotterdam	2008	
Symposium Standardized Assessment of Child Psychopathology: New Developments, Rotterdam	2011	0.3
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MANUSCRIPTS AND PUBLICATIONS

1. Jansen P.W., Verlinden M., Dommissie-van Berkel A., Mieloo C.L., van der Ende J., Veenstra R., Verhulst F.C., Jansen W., Tiemeier H. Prevalence of bullying and victimization among children in early elementary school: Do family and school neighbourhood socioeconomic status matter? *BMC Public Health*. 2012, 12(1):494.
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10. Jansen P.W., Zwirs B., Verlinden M., Mieloo C., Verhulst F.C., Jansen W., Van Ijzendoorn M.H., Tiemeier H. (2014). Observed and parent-reported conscience development: relations with bullying involvement in early primary school. *Submitted for publication*. 2014.

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