

Manuscript version: Author's Accepted Manuscript

The version presented in WRAP is the author's accepted manuscript and may differ from the published version or, Version of Record.

Persistent WRAP URL:

<http://wrap.warwick.ac.uk/154233>

How to cite:

Please refer to published version for the most recent bibliographic citation information. If a published version is known of, the repository item page linked to above, will contain details on accessing it.

Copyright and reuse:

The Warwick Research Archive Portal (WRAP) makes this work of researchers of the University of Warwick available open access under the following conditions.

This article is made available under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0) and may be reused according to the conditions of the license. For more details see: <https://creativecommons.org/licenses/by-nc-nd/4.0/>.



Publisher's statement:

Please refer to the repository item page, publisher's statement section, for further information.

For more information, please contact the WRAP Team at: wrap@warwick.ac.uk.

Associations between language difficulties, peer-victimization and bully-perpetration from three through eight years of age– results from a population-based study

Elise Øksendal^{1,2,3}, Ragnhild Eek Brandlistuen², Dieter Wolke⁵, Siri Saugestad Helland^{2,4}, Arne Holte³, Mari Vaage Wang².

Author affiliations: ¹Department of Research and Development, The Norwegian National Service of Special Needs (Statped) ²Department of Child Health and Development, Norwegian Institute of Public Health ³Department of Psychology, University of Oslo. ⁴Regional Centre for Child and Adolescent Mental Health (RBUP), Eastern and Southern Norway. ⁵Department of Psychology and Warwick Medical School, University of Warwick, Coventry, United Kingdom.

Corresponding author: Elise Øksendal, Department of Research and Development, The Norwegian National Service of Special Needs (Statped). Telephone: +47 98 82 24 21. email: elise.oksendal@statped.no.

The authors declare no conflict of interest

Accepted manuscript

Abstract

Background and purpose: Schoolchildren with language difficulties experience more peer-victimization compared to their typically developing (TD) peers. Whether these children also bully their peers (bully-perpetration) more than TD children is unclear. Furthermore, little is known about peer-victimization and bully-perpetration among preschool children with language difficulties, and how it may be related to different paths of language difficulties. This study aimed to investigate associations between language difficulties, peer-victimization and bully-perpetration from preschool to school age, and the risk of peer-victimization and bully-perpetration for children with different developmental paths of language difficulties and mild language difficulties compared to TD children.

Method: The sample was drawn from the Norwegian Mother, Father and Child Cohort Study (MoBa). Participants with completed questionnaires at three, five and eight years (n=22 628) were included. Paths between latent variables of language skills at three, five and eight years, peer-victimization at five and eight years, and bully-perpetration at eight years were examined with structural equation modelling. Logistic regression was used to investigate peer-victimization and bully-perpetration for predefined paths of language difficulties.

Results: Poor language skills at three and five years were associated with peer-victimization at five years. Poor language skills at five and eight years were associated with peer-victimization and bully-perpetration at eight years. The association between poor language skills at five years and bully-perpetration at eight years was stronger for girls. Persistent paths of language difficulties from three, five to eight years showed the highest risk of peer-victimization and bully-perpetration.

Conclusions: Language difficulties are associated with peer-victimization and bully-perpetration. The risk of peer-victimization and bully-perpetration differs according to different developmental paths of language difficulties from preschool to school age.

Accepted manuscript

Introduction

Language is closely related to children's social development, and influence communication with peers, peer-relationships and engagement in play situations (Irwin et al., 2002; Longobardi et al., 2016). Language is a tool for explaining and understanding one's own feelings, experience and behavior, and becomes increasingly important for emotional regulation (Vallotton & Ayoub, 2011). Indeed, Forrest et al. (2020) found that poor emotional regulation predicted later peer problems and emotional difficulties, and that these associations were stronger among children at risk with language disorders. Moreover, children with poor language skills had reduced trajectories of health-related quality of life compared to typically developing children when measured from four to 13 years of age (Le et al., 2020). Children who do not attain adequate language skills may therefore show more social problems, emotional difficulties and behavioral difficulties (Norbury et al., 2016). Accordingly, children with language difficulties could be less included in social interactions and experience more peer-related conflicts. Thus, making them more prone to peer-victimization, and more involved in bully-perpetration.

Several studies have found that children with language difficulties, including both children with language disorders (e.g. developmental language disorders, specific language impairment [SLI]) and children with poor language skills, experience more bullying and peer-victimization compared to their typically developing (TD) peers (Durkin & Conti-Ramsden, 2010; Knox & Conti-Ramsden, 2003, 2007; McCormack et al., 2011; Redmond, 2011; van den Bedem et al., 2018). However, few studies have investigated if these children also bully others (bully-perpetration) more than TD children. Also, few studies have investigated these associations in preschool children. Previous findings suggest that aggression is associated with language difficulties from

an early age (Wang et al., 2018). Increasing levels of aggressive behavior toward peers could develop into bully-perpetration behavior among young children with language difficulties. In addition, early experiences of peer-victimization may lead to bully-perpetration (Lereya et al., 2015). Despite our understanding and awareness about social integration problems and peer-problems for children with language disorders, there is still a lack of knowledge about peer-victimization and bully-perpetration among these children (Durkin & Conti-Ramsden, 2010; Knox & Conti-Ramsden, 2003). This is important as peer-victimization is found to moderate internalizing difficulties for children with a history of language disorders (Kilpatrick et al., 2019). Peer-victimization could therefore have adverse effects on a range of developmental outcomes beyond pre-existing problems such as language difficulties (Wolke & Lereya, 2015).

Only a limited number of studies have investigated if children with language difficulties are more involved in bully-perpetration compared to their TD peers (Forrest et al., 2018; Rennecke et al., 2020; van den Bedem et al., 2018), and few have included preschool children (Forrest et al., 2018; Rennecke et al., 2020). Interestingly, only Rennecke et al. (2020) found an association between language difficulties and bully-perpetration. These conflicting findings could be because bullying behavior is more frequent among younger children (Ladd et al., 2017). It is also possible that different measures of language and different inclusion criteria for having language difficulties could explain these divergent findings. Bully-perpetration is linked to individual and peer-related difficulties (Pepler et al., 2008), which in turn could influence the development of co-occurring difficulties for children with language difficulties. More research is therefore needed to establish circumstances under which the association between language difficulties and bully-perpetration may occur.

Although children with poor language skills are found to have behavior difficulties and social struggles from an early age (Longobardi et al., 2016; Wang et al., 2018), few studies have investigated if these children also experience more peer-victimization before entering school. McCormack et al. (2011) found that communication impairment measured at four to five years was associated with peer-victimization in school age. Consistent with this, young children with language difficulties and language disorders experienced more peer-victimization at five years compared to their TD peers (Rennecke et al., 2020; Øksendal et al., 2019). While the former study measured language disorders and peer-victimization at different time points, these measures were relatively close to each other. Research investigating the longitudinal associations between language and peer-victimization is therefore still called for (Rennecke et al., 2020).

This is important because different patterns of stability from persistent to full recovery of language difficulties until school age have been previously reported (Henrichs et al., 2011; Zambrana et al., 2014), and different patterns of language development may be differently linked to social difficulties and peer related problems (McKean et al., 2017). Effects of language difficulties on subsequent peer-victimization may therefore differ depending on whether the language difficulties are transient or persistent into school age. Moreover, earlier studies have found different trajectories of peer-problems among children with language disorders (Conti-Ramsden et al., 2019), and that the stability of peer-victimization may vary among young children (Kochenderfer-Ladd & Wardrop, 2001; Wolke, Woods, et al., 2009). Still, it is unknown whether children with language difficulties are more vulnerable to stable trajectories of peer-victimization.

Language is multidimensional, and includes dimensions such as semantics, syntax, pragmatics and phonology. Language seems to be unidimensional when children are young but progressively develops into more distinct dimensions as children grow older (Tomblin & Zhang, 2006). This raises the question of whether the association between language and social problems is dependent on developmental age or type of language difficulty. When investigating how different aspects of language were linked to peer-rejection, van der Wilt et al. (2020) found that children's vocabulary knowledge (receptive skills) was indirectly associated with peer-rejection through oral communicative competence (expressive skills). Furthermore, Rennecke et al. (2019) found that both receptive and expressive language disorders were associated with peer-victimization and bully-perpetration.

Other studies have found that different dimensions of language are differently linked to behavioral difficulties (van Daal et al., 2007). For instance, children with low pragmatic language skills were found to be particularly prone to develop emotional difficulties and peer-problems compared to children with low receptive language skills and low expressive language skills (Conti-Ramsden et al., 2019). In another study, van Daal et al. (2007) found that dimensions of language such as semantic, syntax, speech and phonology correlated negatively with social problems, but only phonology and semantics were associated with internalizing difficulties. Altogether, these findings indicate that various aspects of language may be associated with different aspects of social problems, behavior problems, peer-rejection and peer-victimization.

When investigating how different dimensions of language were related to language difficulties, a Norwegian study found that most children with language difficulties had poor semantic language skills (Ottem, 2009). Similarly, McCabe and Meller (2004) found that semantic language skills was an important indicator of

language difficulties among preschool children. Interestingly, although poor semantic language skills had the highest correlation to peer-problems and being withdrawn, a significant correlation with aggressive behavior was not found (van Daal et al., 2007). Researchers argue that social problems without overt aggressive behavior may go undetected by parents, teachers and caregivers (Conti-Ramsden & Botting, 2004). It is therefore possible that children with poor semantic language skills are involved in negative peer interactions such as peer-victimization and bully-perpetration, without receiving adequate help.

The diversity of findings may also be explained by sample differences. Earlier studies that investigated language difficulties and peer-victimization have mostly used clinical samples (Conti-Ramsden & Botting, 2004; Durkin & Conti-Ramsden, 2010; Knox & Conti-Ramsden, 2003, 2007; Redmond, 2011; van den Bedem et al., 2018). Although clinical samples may give an accurate measure of language difficulties, clinical samples could be biased towards the most severe cases of language difficulties (Rutter & Mawhood, 1991). Children with more severe and stable language difficulties may receive more academic and social support or experience more stigmatizing behavior compared to children with mild language difficulties. With a longitudinal population-based sample, which also includes children with a wider continuum of language skills and difficulties, it is possible to investigate children with different severity and different developmental paths of language difficulties and how these might be associated with peer-victimization and bully-perpetration across time.

Previous findings indicate that boys' language develop later than girls (Brandlistuen et al., 2020). Boys are also over-represented among children with language difficulties (Hollund-Møllerhaug, 2010; Zubrick et al., 2007) and among children involved in bullying behavior (Wolke et al., 2001). In addition, earlier studies

indicate that boys and girls with language difficulties show different development of co-occurring difficulties (Helland et al., 2018; Stowe et al., 1999). This could influence the association to peer-victimization and bully-perpetration for boys and girls with language difficulties. Researchers that investigated language difficulties, peer-victimization and bully-perpetration mostly presented their results adjusted for gender effects (Forrest et al., 2018; McCormack et al., 2011; Øksendal et al., 2019). Thus, little is known about gender difference in the paths between language difficulties, peer-victimization and bully-perpetration.

Bullying is defined by repeated aggression (2-3 times a month) where the behavior is intended to harm, and there is a real or perceived imbalance of power between the victim and the perpetrator (Solberg & Olweus, 2003). Peer-victimization is a form of peer abuse in which a child is regularly the target of aggression, but does not necessarily include all aspects of the bullying definition (Kochenderfer & Ladd, 1996). Bully-perpetration is the act of victimizing others. Owing to cognitive and social immaturity, imbalance of power and intention to harm may be difficult to measure among young children (Vlachou et al., 2011). The terms “peer-victimization” and “bully-perpetration” are therefore defined more loosely in our study compared to the term “bullying”.

In the current study we have used a large population-based sample to investigate the associations between language difficulties, peer-victimization and bully-perpetration. We used two approaches, where first, we investigate these associations with latent continuous measures of children’s language skills, and second, by comparing children with language difficulties to TD children. The aim of the current study was to investigate stability and change between language skills measured at three, five and eight years, peer-victimization measured at five and eight years and

bully-perpetration measured at eight years. We also aimed to investigate the risk of peer-victimization/bully-perpetration for children with predefined developmental paths of language difficulties compared to children without language difficulties. More specifically, the following hypotheses were investigated:

- 1) Children with language difficulties are more involved in bullying behavior compared to children without language difficulties
- 2) These associations will be stronger for boys and for children with stable paths of language difficulties
- 3) There will be cumulative associations between poor language skills and bullying behavior shown across children's development
- 4) Children with mild language difficulties are more vulnerable to peer-victimization/bully-perpetration compared to children without language difficulties

Method

Participants

Data from the Norwegian Mother, Father and Child Study (MoBa) was used. MoBa is a prospective population-based pregnancy cohort study conducted by the Norwegian Institute of Public Health (Magnus et al., 2016) (<https://www.fhi.no/en/studies/moba/>). Participants were recruited from all over Norway between 1999-2008. Mothers that were invited to participate consented to participation in 41% of the pregnancies. The cohort now includes 114 500 children and 95 200 mothers. Information on health, lifestyle and child development was collected by questionnaires during pregnancy and after birth. For the present study, 22 628 children (11 500 boys and 11 128 girls) with complete questionnaires at three, five and

eight years of age were included. The tenth, quality assured version of the dataset released in 2017 was used in the current study.

The establishment of MoBa and initial data collection was based on a license from the Norwegian Data Protection Authority and approval from The Regional Committees for Medical and Health Research Ethics. The MoBa cohort is based on regulations from the Norwegian Health Registry Act. Written informed consent was obtained from all participants. The Norwegian Data Protection Authority has approved this study.

Measurements

Children's language skills at three, five and eight years were assessed with selected items for MoBa from validated measurement scales (shown in supplementary Appendix A). These items were indicators of our latent variables and used to create the categorical variables. Language at three years was measured with five items from the Ages and Stages Questionnaires (ASQ). The parental ASQ is a widely used screening instrument for assessing children's development (Squires et al., 1997). The 36-months questionnaire has shown good discriminative power for identifying school-related difficulties among children born premature (Halbwachs et al., 2014). In MoBa, measures of communication and motor skills are included. ASQ has been used in previous studies investigating young children with language difficulties (Jin et al., 2020; Zambrana et al., 2014). The validity of ASQ has been demonstrated in a Norwegian context (Richter & Janson, 2007). Gadermann et al. (2012) argue that when a scale is measured with categorical indicators, and has a skewed distribution across response categories, Cronbach's alpha may underestimate the reliability of the scale. Ordinal alphas were therefore calculated based on the polychoric correlation matrix (Gadermann et al., 2012). Polychoric reliability for ASQ was .91 in this study.

Language at five and eight years were measured with eight items assessing semantic language skills from the 20-item checklist (Language 20Q) (Ottem, 2009). Semantic language skills represent the ability to comprehend the meaning of words, which may include both understanding and communicating language (Ottem, 2009). The Language 20Q is used as a screening instrument for detecting language difficulties among Norwegian children, and the predictive validity of Language 20Q has been demonstrated (Ottem, 2009). Because poor semantic language skills are clear indicators of language difficulties (McCabe & Meller, 2004; Ottem, 2009), and are associated with social problems (van Daal et al., 2007), semantic language skills were used to measure poor language skills and language difficulties at five and eight years. Polychoric reliability for Language 20Q was .93 at five and eight years in this study.

Language skills were estimated as latent, continuous variables with categorical indicators, and were included in our autoregressive cross-lagged model. Latent variables are adjusted for bias owing to random error and construct irrelevant variance and could therefore make our measurements more robust (Tomarken & Waller, 2005). The distribution of responses to the categorical indicators was skewed, suggesting that most children had few or no symptoms of language difficulties. Variation was thus concentrated in the higher end of the language scales because high scores indicated difficulties. Developmental paths of language difficulties were measured with categorical variables and were included in our logistic regression analyses.

Previous studies have found that approximately seven to 10% of children were identified as having language difficulties (Hollund-Møllerhaug, 2010; Norbury et al., 2016). Accordingly, earlier studies assessing language difficulties utilizing MoBa-data have set a predefined cutoff of 1.5 standard deviation below the mean (Jin et al., 2020; Zambrana et al., 2014) corresponding to approximately 10%. In the current study,

groups within the highest ~90th percentile (indicating difficulties) were created to investigate different developmental paths of language difficulties. We created mean scores to measure language difficulties. Cutoff was set at a mean value of 1.40 at 3 years (1-3), 2.14 at 5 years (1-5) and 2.13 at 8 years (1-5), which included 8295 children at three years, 3023 children at five years and 3224 children at eight years. When creating groups of children with mild language difficulties, a slightly wider estimate of ~80th percentile (indicating mild difficulties) was used. Demographic and developmental details for these groups are shown in tables 1 and 2.

-Insert Table 1 here-

-Insert Table 2 here-

Peer-victimization at five years was measured by mother's rating of the statement, "My child is teased/bullied by other children", during the past two months. Response categories were "never", "sometimes" or "often". Peer-victimization at eight years was measured by mother's rating of the question "In the past 12 months has your child been teased or bullied by other children?". Response categories were "never", "seldom", "two or three times a month", "once a week" or "many times a week". Bully-perpetration was only available at eight years and was measured by mother's rating of the question: "In the past 12 months has your child participated in teasing or bullying other children?". Response categories were "never", "seldom", "two or three times a month", "once a week" or "many times a week". The measures of peer-victimization and bully-perpetration at eight years corresponded to the measures used for Norwegian school children, where peer-victimization and bully-perpetration is assessed annually for fifth grade students and older (Wendelborg, 2020).

In logistic regression analysis, peer-victimization and bully-perpetration were dichotomized. At five years, "sometimes" and "often" corresponded to peer-

victimization. At eight years, “two or three times a month”, “once a week” and “many times a week” corresponded to peer-victimization and bully-perpetration. In the autoregressive cross-lagged model, peer-victimization and bully-perpetration were included as observed variables using the whole range of the response indicators.

Premature children are at increased risk of peer-victimization (Liu et al., 2019; Wolke, Baumann, et al., 2015) and poor language skills (Putnick et al., 2017; Stene-Larsen et al., 2014; Wolke, Samara, et al., 2008). Results were therefore adjusted for gestational age at birth < 37 weeks. Information about gestational age and the child’s gender was retrieved from the Medical Birth Registry of Norway, which is a national health registry containing information about all births in Norway (Irgens, 2000). The full range of available measures included in all MoBa-questionnaires is described in detail at the following website: (<https://www.fhi.no/en/studies/moba/for-forskere-artikler/questionnaires-from-moba/>)

Statistical analysis

Confirmatory factor analysis (CFA) was used to conduct measurement models for how well the categorical indicators reflect the latent variables. CFA is hypothesis driven, which means that all aspects of the CFA model are pre-specified (Brown, 2006). After developing measurement models, the unadjusted bivariate correlations between all variables included in our autoregressive cross-lagged model were investigated (Table 3). Last, an autoregressive cross-lagged panel model was used to investigate the relationships between language skills, peer-victimization and bully-perpetration. Only significant paths were included in our final model. Comparative fit index (CFI), Tucker-Lewis Index (TLI) and root mean square error of approximation (RMSEA), were used as fit indices for the measurement models and the structural equation model (SEM). Although RMSEA, TLI and CFI are found to be less

prominent in discovering model-data misfit when ordered categorical data are used, alternative model fit parameters have not yet been agreed upon (Xia & Yang, 2019).

The stability of language skills was accounted for by estimating the autoregression between each point of measurement. To control for the time invariant associations between measurements in our model, the correlation between language skills at three and eight years was estimated, and comparable items at five and eight years were allowed to co-vary. Although the unadjusted correlation between language skills measured at three years and bully-perpetration at eight years was positive, this association was negative in the full model, and was therefore set to zero.

First, all direct paths between variables were investigated, and then the indirect paths between language skills at three years and peer-victimization/bully-perpetration at eight years were investigated. Nested models grouped by gender were also investigated. As a default the measurement models for boys and girls were set be equal, and the paths between boys and girls were compared. To account for confounding due to premature gestational age and age difference between children at the time of filling out the questionnaires, results were adjusted for the child's age at three, five and eight years, and gestational age at birth < 37 weeks. Analyses were performed in Mplus version 8 (Muthén & Muthén, 2017). As mentioned earlier, our variables were highly skewed. The weighted least squares mean and variance (WLSMV) is a robust estimator that accounts for skewed variables, and offers the best alternative for modeling categorical data (Brown, 2006). WLSMV was used in this study.

Groups representing different developmental paths of language difficulties were created. The persistent language difficulties group included children that had difficulties at all measurement points. The transient language difficulties group

included children that had difficulties at three and five years, but not eight years. The late onset language difficulties group included children that only had difficulties at eight years. These groups were included in logistic regression analysis where the risk of peer-victimization and bully-perpetration for children with different paths of language difficulties as opposed to having no language difficulties at three, five and eight years were investigated. Last, a mild language difficulty group was created. Children that were not included in any of the previous language difficulties groups, but still had measures corresponding to ~80th percentile (indicating mild difficulties) at three, five and eight years were included. In a separate analysis, the risk of peer-victimization and bully-perpetration for children with mild language difficulties as opposed to having no language difficulties were estimated. Results show crude odds ratio (OR) and OR adjusted for gender and gestational age at birth < 37 weeks. Analyses were performed using SPSS version 25 (IBM, Armonk, New York).

Results

Descriptive results of peer-victimization/bully-perpetration

When measured as dichotomized variables, 3.8% (1550) were exposed to peer-victimization at five years and 7.5% (3210) were exposed to peer-victimization at eight years. A total of 2.4% (1039) were involved in bully-perpetration at eight years. About 72% of children that were involved in bully-perpetration were also exposed to peer-victimization at eight years, and 24% of children that were exposed to peer-victimization at eight years were also involved in bully-perpetration.

Measurement models of language skills

When investigated in our autoregressive model, latent variables of language skills were included (Figure 1). At three years CFA for language skills showed factor loadings ranging from .72 to .90 (CFI=.997, TLI=.994, RMSEA=.023). At five years

CFA for language skills showed factor loadings ranging from .73 to .86 (CFI=.977 TLI=.968 RMSEA=.073) At eight years CFA for language skills showed factor loadings ranging from .66 to .88 (CFI=.986 TLI=.981. RMSEA=.059). These results show adequate model fit.

Unadjusted polychoric correlations

Unadjusted bivariate polychoric correlations between language skills at three, five and eight years, peer-victimization at five and eight years, bully-perpetration at eight years and gender are shown in Table 3.

-Insert Table 3 here-

Language skills, peer-victimization and bully-perpetration in SEM

-Insert Figure 1 here-

Figure 1 shows the autoregressive cross-lagged model illustrating paths between language skills measured at three, five and eight years, peer-victimization at five and eight years and bully-perpetration at eight years. The autoregressive paths show the stability of language skills and peer-victimization, and the cross-lagged paths are adjusted for the stability from earlier measurements for each variable. This means that poor language skills at five years predicted peer-victimization at eight years, adjusted for peer-victimization at five years, indicating an association between poor language skills at five years and change of peer-victimization from five to eight years.

Poor language skills at five years was associated with bully-perpetration at eight years ($\beta=.086$; 95% confidence intervals [CI] .064–.109 $p<.001$), and poor language skills and bully-perpetration correlated at eight years ($r=.053$; 95% CI .030–.077 $p<.001$). Poor language skills at five years was associated with increasing peer-victimization at eight years ($\beta=.096$; 95% CI .062–.129 $p<.001$). Poor language skills and peer-victimization correlated at five years ($r=.187$; 95% CI .143–.230 $p<.001$) and

at eight years ($r=.056$; 95% CI $.032-.080$ $p<.001$). Poor language skills at three years was associated with peer-victimization at five years ($\beta=.192$; 95% CI $.148-.237$ $p<.001$). Last, peer-victimization at five years was associated with increased symptoms of poor language skills at eight years ($\beta=.068$; 95% CI $.040-.096$ $p<.001$). Altogether, this indicates that poor language skills, peer-victimization and bully-perpetration are associated from an early age.

Autoregressive paths show high stability of language skills from three to five years ($\beta=.665$; 95% CI $.646-.683$ $p<.001$) and from five to eight years of age ($\beta=.548$; 95% CI $.523-.573$ $p<.001$). Peer-victimization at five years was associated with peer-victimization ($\beta=.345$; 95% CI $.313-.378$ $p<.001$) and bully-perpetration at eight years ($\beta=.193$; 95% CI $.157-.229$ $p<.001$). There was a strong correlation between peer-victimization and bully-perpetration at eight years ($r=.645$; 95% CI $.632-.658$ $p<.001$).

When investigating mediation effects in our model, our results show that the association between poor language skills measured at three years and peer-victimization measured at eight years was mediated by poor language skills at five years ($\beta=.064$; 95% CI $.041-.086$ $p<.001$), and peer-victimization at five years ($\beta=.066$; 95% CI $.050-.083$ $p<.001$). The association between poor language skills at three years and bully-perpetration at eight year was mediated by poor language skills at five years ($\beta=.057$; 95% CI $.043-.072$ $p<.001$), and peer-victimization at five years ($\beta=.037$; 95% CI $.026-.048$ $p<.001$). These results indicate that the stability of poor language skills from three to five years increase peer-victimization/bully-perpetration at eight years, and that peer-victimization at five years could mediate the association between poor language skills at three years and peer-victimization/bully-perpetration at eight years.

Finally, gender difference in our model was investigated. The path from poor language skills measured at five years to bully-perpetration at eight years was significantly higher for girls ($\beta=.109$; 95% CI .076–.142 $p<.001$), compared to boys ($\beta=.045$; 95% CI .016–.075 $p=.003$). When each path was constrained, and the models for boys and girls were compared using the Wald chi-square test, the association between peer-victimization at five years and bully-perpetration at eight years was stronger for boys and the correlation between peer-victimization and bully-perpetration at eight years was stronger for girls.

The chi-square test ($\chi^2=4728.362$), for the structural model was significant ($p<.001$; $DF=317$). The chi-square is often significant in a large data set. Parameters such as RMSEA, CFI and TLI were therefore used to estimate model fit. RMSEA was .025, CFI was .983 and TLI was .980. These measures indicate good model fit.

Peer-victimization and bully-perpetration for different paths of language difficulties and mild language difficulties

A total of 22 048 children with complete measures of language skills at three, five and eight years of age were included in logistic regression analysis. Of these children, 20 549 did not have language difficulties at any of the measurement points and comprised the reference group. The persistent language difficulties group (language difficulties at three, five and eight years) consisted of 461 children (2.1%), the transient language difficulties group (language difficulties at only three and five years) consisted of 347 children (1.6%), and the late onset group (language difficulties at only eight years) consisted of 691 children (3.1%). In addition, 650 children with mild language difficulties at three, five and eight years were included in a separate group. Table 4 shows the crude and adjusted OR of peer-victimization at five and eight years and bully-perpetration at eight years for children with different developmental

paths of language difficulties and mild language difficulties as opposed to having no language difficulties.

It is well known that language difficulties and symptoms of ADHD influence each other from an early age (Ribeiro et al., 2011; Wang et al., 2018). In addition, symptoms of ADHD are associated with bullying behavior (Verlinden et al., 2015). Attention difficulties/hyperactivity could therefore explain associations between language difficulties and peer-victimization/bully-perpetration. Accordingly, we performed sensitivity analyses adjusted for attention difficulties/hyperactivity (results shown in supplementary Appendix B). Although these adjustments had some influence on the magnitude of our results, the CIs of these results overlapped with the CIs for the adjusted ORs shown in Table 4. Thus, indicating that our findings could not be explained by co-occurring attention difficulties/hyperactivity.

-Insert Table 4 here-

The highest risk of peer-victimization at five and eight years, and bully-perpetration at eight years was found among children with persistent language difficulties. Children with transient, late onset and mild language difficulties also had an increased risk of peer-victimization at five and eight years, and children with late onset and mild language difficulties had an increased risk of bully-perpetration at eight years. This indicates that children with mild and fleeting paths of language difficulties are more prone to peer-victimization and bully-perpetration as opposed to those having no language difficulties. In addition, our results show that the risk of peer-victimization for children with transient language difficulties is higher at five years than peer-victimization/bully-perpetration at eight years. This indicates that the risk of being involved in bullying behavior decreases with decreasing symptoms of language difficulties.

Discussion

The aim of the current study was to investigate associations between language difficulties, peer-victimization and bully-perpetration from three through eight years of age. First, our results show that poor language skills at five years influence bully-perpetration and peer-victimization at eight years. Although these estimates were small due to conventional standards (Cohen, 1992), it is important to consider that they were adjusted for earlier measures of language skills and peer-victimization. Also, our results show a modest association between poor language skills and peer-victimization at five years, after adjusting for earlier measures of language skills, and a modest association between poor language skills at three years and peer-victimization at five years.

Second, our results show that the path from poor language skills at five years to bully-perpetration at eight years is stronger for girls. Third, our results show that children with persistent and stable language difficulties have the highest risk of peer-victimization and bully-perpetration and the effect size is moderate. Last, our results show that children with transient, late onset and mild language difficulties also have an increased risk of bully-perpetration and peer-victimization compared to children without language difficulties.

Our results resemble current findings indicating that children with language disorders are involved in bully-perpetration from an early age (Rennecke et al., 2020). Rodkin et al. (2015) suggest that children bully peers to gain power by creating weakness in the child being exposed to bullying. Children with language difficulties may therefore participate in bully-perpetration to obtain a more favorable position in the peer group. Interestingly, van den Bedem et al. (2018) did not find that children with language disorders bullied their peers more than TD children. Moreover, although

Forrest et al. (2018) found that children with language disorders at five years experienced more peer-problems at seven years when rated by their teachers, these children did not experience more peer-victimization, nor did they bully their peers more than children in the general population. Thus, showing some contrasting findings compared to our results. This could be because these associations were investigated among older children (eight to 16 years of age) in the first study (van den Bedem et al., 2018), and with more emphasis on expressive language impairment in the latter study (Forrest et al., 2018).

Bullying behavior generally decreases as children grow older (Ladd et al., 2017), which could indicate that higher estimates of bully-perpetration may be found among younger children. Furthermore, van Daal et al. (2007) found that different dimensions of language were differently linked to behavior problems. Poor semantic language skills showed among the highest correlation with social difficulties and being withdrawn (van Daal et al., 2007). Another study found that lower vocabulary range was associated with less self-regulation skills among toddlers (Vallotton & Ayoub, 2011). In addition, poor self-control and being disliked have been linked with bully-perpetration among school children (Bacchini et al., 2008; Unnever & Cornell, 2003). Poor semantic language skills could therefore show different associations to bully-perpetration compared to other dimensions of language.

An interesting finding was that the association from poor language skills at five years to bully-perpetration at eight years was stronger for girls. Former research suggest that girls' language skills mature earlier than boys (Brandlistuen et al., 2020; Henrichs et al., 2011). It is therefore possible that early play and social interaction among young girls include more advanced language compared to boys. Girls with poor language skills may therefore have a lower status in the peer group and participate in

bully-perpetration to receive a higher status. This could be different for young boys, where motor skills and athletic competence play a different role in enhancing status and popularity (Chase & Dummer, 1992). Research has found that girls with language difficulties are especially vulnerable to develop co-occurring internalizing difficulties as they transition to school (Helland et al., 2018). Although boys are over-represented among children with language difficulties (Hollund-Møllerhaug, 2010; Zubrick et al., 2007), girls may be viewed as more deviant compared to a social gender norm (Helland et al., 2018). Girls with poor language skills could therefore be susceptible to develop adverse strategies when approaching peers. Stowe et al. (1999) found that even though disruptive behavior was more common among boys with language difficulties, disruptive behavior also increased the likelihood of referral to support services. The researchers argue that boys with language difficulties may be more likely to receive professional help and support compared to girls. Conversely, girls' difficulties may go undetected by adults, thus increasing environmental stress and negative interaction with peers (Stowe et al., 1999).

Another important finding was that children with poor language skills at three and five years were more exposed to peer-victimization at five years, and that children with poor language skills at five and eight years also were increasingly exposed to peer-victimization at eight years. Our results resemble earlier findings showing that preschool children with communication impairment, language difficulties and language disorders (McCormack et al., 2011; Rennecke et al., 2020; Øksendal et al., 2019), and school children with language difficulties and language disorders (Durkin & Conti-Ramsden, 2010; Redmond, 2011; van den Bedem et al., 2018), are at increased risk of peer-victimization. Our results strengthen the validity of these findings by showing that the association between poor language skills and peer-

victimizations still holds after adjusting for earlier measures of language skills and peer-victimization. Thus, indicating that these associations persist across time.

Rice et al. (1991) found that preschool children with limited communication skills use shorter sentences, are less preferred communication partners, and communicate more with adults compared with TD children. Consequently, these children could be less included in social interactions and play-activities with peers. Another study found that private speech among pre-schoolers predicted social skills and behavior difficulties (Winsler et al., 2003). Abdul Aziz et al. (2017) found that young children with SLI use less private speech on problem-solving tasks compared to their TD peers. Children with language difficulties may therefore appear less mature and more frustrated when interacting with peers, which could make them more prone to peer-victimization. Moreover, language is an important means for children to express if something is troubling them. It is therefore possible that young children with language difficulties struggle to reveal incidents of peer-rejection or peer-problems to parents, teachers or caregivers. Consequently, these incidences may persist and develop into peer-victimization.

Finally, our results show an association between peer-victimization at five years and language skills at eight years. Thus, indicating that peer-victimization measured at five years predicted poor language skills at eight years. Helland et al. (2018) found bidirectional associations between language difficulties and internalizing difficulties from 18 months through eight years of age. It is therefore possible that peer-victimization influence internalizing difficulties, which in turn influence poor language skills.

As expected, our results show that children with persistent language difficulties from three through eight years had the highest risk of peer-victimization and bully-

perpetration. Likewise, for children with poor language skills at three years the association to peer-victimization/bully-perpetration at eight years was mediated by poor language skills at five years. This indicates that persistent language difficulties increase peer-victimization and involvement in bully-perpetration. St Clair et al. (2011) found that children with specific language impairment (SLI), measured from seven through 16 years of age, showed increasing levels of peer-difficulties. However, this study did not investigate whether children with different developmental paths of SLI were differently associated with peer-difficulties. McCormack et al. (2011) included 24% of their sample as children with communication difficulties. Thus, even when applying a wider estimate of communication difficulties than is commonly used in the literature, they still found that these children were more exposed to peer-victimization. However, mild difficulties were not investigated separately.

Our results expand current knowledge by showing an increased risk of peer-victimization from five to eight years and bully-perpetration at eight years for children with late onset language difficulties and mild language difficulties, and an increased risk of peer-victimization from five to eight years for children with transient language difficulties. Accordingly, our results show that the associations between poor language skills at three years and peer-victimization/bully-perpetration at eight years were mediated by peer-victimization at five years. Previous studies have found that late talking toddlers exhibit lower social and emotional competence compared to their TD peers (Irwin et al., 2002; Longobardi et al., 2016). Thus, revealing an early vulnerability to peer-related problems. Although bullying behavior generally decreases from preschool to school age, some children show persistent trajectories of peer-victimization (Ladd et al., 2017; Oncioiu et al., 2020). Furthermore, research has found that early experiences of peer-victimization may lead to bully-perpetration (Lereya et

al., 2015). It is therefore possible that children with transient language difficulties or poor language skills at three years will be targeted already as preschoolers, which in turn could make them more prone to peer-victimization and bully-perpetration in school years, despite possible language skills improvements.

Our results highlight the need for more awareness about children that struggle with language, without necessarily having persistent developmental paths of language difficulties. Glogowska et al. (2006) found that many preschoolers with language delay that were not prioritized for professional support still showed increased literacy struggles and peer-related struggles when measured as schoolchildren compared to their age matched peers (Glogowska et al., 2006). Children with mild or fleeting paths of language difficulties could have difficulties that are less obvious for parents and professionals. Consequently, peer-problems and social struggles may go unnoticed and develop into peer-victimization and bully-perpetration among these children.

Strengths and limitations

The current study used a large population-based sample to investigate the associations between language difficulties, peer-victimization and bully-perpetration across time. First, associations between language difficulties and bully-perpetration have rarely been investigated. Hence, our findings give new knowledge about these associations. Second, language difficulties were measured with both categorical and with latent variables. Latent variables, which accounted for measurement error and the non-normal distribution of the items, were included in an autoregressive cross-lagged model. Using latent variables could therefore make the estimates in our model more reliable. In addition, our model gave us the opportunity to discuss longitudinal associations between language skills, peer-victimization and bully-perpetration. Last,

by using both latent variables and categorical variables, our results give robust support for the vulnerability of children language difficulties.

Adachi and Willoughby (2015) argue that controlling for the stability of effects is the gold standard of longitudinal designs. This is because it allows the researchers to examine if the variables of interest predict the outcome over time, while controlling for earlier measures of the outcome (Adachi & Willoughby, 2015). Therefore, when controlling for measurement stability, it was possible to examine how language skills predicted change in peer-victimization measured prospectively.

However, an important critique of the cross-lagged model is that it is not possible to separate the within-person stability from between-person stability (Hamaker et al., 2015). Intra-individual differences such as family or child characteristics could therefore reflect the stability of our measurements. As shown in tables 1 and 2, many of the children with language difficulties in our study also had co-occurring difficulties such as attention difficulties/hyperactivity, behavioral difficulties and emotional difficulties. Research has shown that children with these difficulties are more often exposed to peer-victimization and involved in bully-perpetration (Arseneault et al., 2010; Verlinden et al., 2015). It is therefore possible that co-occurring difficulties, rather than merely the language ability, could explain the associations between language difficulties and peer-victimization/bully-perpetration found in our study. However, given that the association between language difficulties and co-occurring difficulties is apparent from such an early age (Helland et al., 2018; Wang et al., 2018), we argue that our findings show the observed association to peer-victimization/bully-perpetration that children with language difficulties experience in their natural environment. In addition, we have previously found that children with language difficulties without co-occurring difficulties had an increased risk of peer-

victimization (Øksendal et al., 2019). Thus, indicating that the association with peer-victimization not only applies to children with co-occurring difficulties.

Many of the estimates in our model are small according to conventional standards. Adachi and Willoughby (2015) have demonstrated that controlling for measurement stability can reduce effect size coefficients in SEM. Accordingly, many of our coefficients shown as unadjusted correlations (Table 3) were greatly reduced in our autoregressive cross-lagged model (Figure 1). In addition, our results resemble previous findings by showing moderate to high stability of poor language skills from three, five to eight years (Helland et al., 2018), and peer-victimization from preschool to school age (Ladd et al., 2017). The amount of change in peer-victimization that results from poor language skills is therefore expected to be modest. Still, small effect sizes can be important (McCartney & Rosenthal, 2000). Our results indicate ongoing cumulative associations between poor language skills, peer-victimization and bully-perpetration. The negative consequences of peer-victimization and bully-perpetration have been established in many studies (Arseneault et al., 2010; Kim et al., 2011; Wolke et al., 2013). Our findings therefore give new knowledge as to whom might be early targets.

Our study is among the first to investigate the risk of peer-victimization and bully-perpetration among children with different developmental paths of language difficulties and children with mild language difficulties. This was done by creating groups of children with persistent, transient, late onset and mild language difficulties. Unfortunately, some of these groups were small. This resulted in large CIs for some of our ORs. Point estimates should therefore be interpreted with caution bearing in mind the full range of the CI.

Given that MoBa is a population-based longitudinal study, selective attrition is an important concern. Previous research has found that using a sample that includes at least some of the most troubled individuals with the most severe difficulties could moderate bias due to selective non-response in longitudinal studies (Gustavson et al., 2019). Our sample contains variations with high and low rates of language skills. This could reduce self-selection bias owing to attrition. Moreover, possible self-selection bias in MoBa has been examined by investigating differences in prevalence estimates between MoBa participants and Norwegian mothers. MoBa participants tend to have better health and socioeconomic status compared to Norwegian mothers (Nilsen et al., 2009). Self-selection bias could therefore influence exposure-outcome estimates in our study (Biele et al., 2019). However, when tested using both actual data and simulations, even large selection bias may have little effect on the regression coefficients (Wolke, Waylen, et al., 2009).

Parents are reliable informants on their child's language development (Lyytinen et al., 1996) and their child's involvement in peer-victimization (Shakoor et al., 2011). In our study, mothers were assessing language, peer-victimization and bully-perpetration. Consequently, shared variance due to stable characteristics belonging to the mother could influence our estimates. Direct measures of language ability and supplementary measures of peer-victimization/bully-perpetration from the teacher or child would probably strengthen our results but was not available. Last, language and peer-victimization were measured somewhat differently at different ages, and measurement invariance could not be established between boys and girls. This could threaten the comparability of our variables across time and between boys and girls.

Conclusion

Our findings give robust support for the vulnerability of children with language difficulties. Language difficulties in preschool years, in particular if stable and persistent, puts children at increased risk of both peer-victimization but also engagement in perpetrating bullying. An increased vulnerability was also found for children with mild and fleeting paths of language difficulties. An important finding was that girls with poor language skills showed stronger associations to bully-perpetration compared to boys. Thus, highlighting the need to be aware that although more boys have difficulties, girls with poor language skills may be more involved in negative peer-interactions. Poor language skills and peer-victimization were both found to be moderately stable over time. Parents and teachers should be aware that children with language difficulties measured in preschool and school years are more exposed to peer-victimization and more involved in bully-perpetration measured concurrently and prospectively.

Acknowledgments

The Norwegian Mother, Father and Child Cohort Study is supported by the Norwegian Ministry of Health and Care Services and the Ministry of Education and Research. We are grateful to all the participating families in Norway who take part in this ongoing cohort study.

Data consent

The consent given by the participants does not open for storage of data on an individual level in repositories or journals. Researchers who want access to data sets for replication should submit an application to datatilgang@fhi.no. Access to data sets requires approval from the Regional committees for medical and health research ethics in Norway and a formal contract with MoBa.

References

- Abdul Aziz, S., Fletcher, J., & Bayliss, D. M. (2017). Self-regulatory speech during planning and problem-solving in children with SLI and their typically developing peers. *International Journal of Language and Communication Disorders*, 52(3), 311-322. <https://doi.org/10.1111/1460-6984.12273>
- Adachi, P., & Willoughby, T. (2015). Interpreting effect sizes when controlling for stability effects in longitudinal autoregressive models: Implications for psychological science. *European Journal of Developmental Psychology*, 12(1), 116-128. <https://doi.org/10.1080/17405629.2014.963549>
- Arseneault, L., Bowes, L., & Shakoor, S. (2010). Bullying victimization in youths and mental health problems: 'Much ado about nothing'? *Psychological Medicine*, 40(5), 717-729. <https://doi.org/10.1017/S0033291709991383>
- Bacchini, D., Affuso, G., & Trotta, T. (2008). Temperament, ADHD and peer relations among schoolchildren: The mediating role of school bullying. *Aggressive Behavior*, 34(5), 447-459. <https://doi.org/10.1002/ab.20271>
- Biele, G., Gustavson, K., Czajkowski, N. O., Nilsen, R. M., Reichborn-Kjennerud, T., Magnus, P. M., Stoltenberg, C., & Aase, H. (2019). Bias from self selection and loss to follow-up in prospective cohort studies. *European Journal of Epidemiology*, 34, 927-938. <https://doi.org/10.1007/s10654-019-00550-1>
- Brandlistuen, R. E., Flatø, M., Helland, S. S., Stoltenberg, C., & Wang, M. V. (2020). Gender gaps in preschool age: A study of behavior, neurodevelopment and pre-academic skills. *Scandinavian Journal of Public Health*. <https://doi.org/10.1177/1403494820944740>
- Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. The Guilford Press.
- Chase, M. A., & Dummer, G. M. (1992). The role of sports as a social status determinant for children. *Research Quarterly for Exercise and Sport*, 63(4), 418-424. <https://doi.org/10.1080/02701367.1992.10608764>
- Cohen, J. (1992). A power primer. *Psychological Bulletin*, 112(1), 155-159. <https://doi.org/10.1037//0033-2909.112.1.155>
- Conti-Ramsden, G., & Botting, N. (2004). Social difficulties and victimization in children with SLI at 11 years of age. *Journal of Speech, Language and Hearing Research*, 47(1), 145-161. [https://doi.org/10.1044/1092-4388\(2004/013\)](https://doi.org/10.1044/1092-4388(2004/013))
- Conti-Ramsden, G., Mok, P., Durkin, K., Pickles, A., Toseeb, U., & Botting, N. (2019). Do emotional difficulties and peer problems occur together from childhood to adolescence? The case of children with a history of developmental language disorder (DLD). *European Child and Adolescent Psychiatry*, 28(7), 993-1004. <https://doi.org/10.1007/s00787-018-1261-6>
- Durkin, K., & Conti-Ramsden, G. (2010). Young people with specific language impairment: A review of social and emotional functioning in adolescence. *Child Language Teaching and Therapy*, 26(2), 105-121. <https://doi.org/10.1177/0265659010368750>
- Forrest, C. L., Gibson, J. L., Halligan, S. L., & St Clair, M. C. (2018). A longitudinal analysis of early language difficulty and peer problems on later emotional

- difficulties in adolescence: Evidence from the Millennium Cohort Study. *Autism and Developmental Language Impairments*.
<https://doi.org/10.1177/2396941518795392>
- Forrest, C. L., Gibson, J. L., Halligan, S. L., & St Clair, M. C. (2020). A cross-lagged analysis of emotion regulation, peer problems, and emotional problems in children with and without early language difficulties: Evidence from the Millennium Cohort Study. *Journal of Speech and Language Hearing Research*, 63(4), 1227-1239. https://doi.org/10.1044/2020_JSLHR-19-00188
- Gadermann, A. M., Guhn, M., & Zumbo, B. D. (2012). Estimating ordinal reliability for likert-type and ordinal item response data: A conceptual empirical and practical guide. *Practical Assessment*, 17(3), 1-13.
<https://doi.org/10.7275/n560-j767>
- Glogowska, M., Roulstone, S., Peters, T. J., & Enderby, P. (2006). Early speech- and language-impaired children: Linguistic, literacy, and social outcomes. *Developmental Medicine and Child Neurology*, 48(6), 489-494.
<https://doi.org/10.1111/j.1469-8749.2006.tb01301.x>
- Gustavson, K., Røysamb, E., & Borren, I. (2019). Preventing bias from selective non-response in population-based survey studies: Findings from a Monte Carlo simulation study. *BMC Medical Research Methodology*, 19(1), 120.
<https://doi.org/10.1186/s12874-019-0757-1>
- Halbwachs, M., Muller, J. B., Nguyen the Tich, S., Gascoin, G., Chauty-Fronidas, A., Branger, B., Rouger, V., Roze, J.-C., & Flamant, C. (2014). Predictive value of the parent-completed ASQ for school difficulties in preterm-born children <35 weeks' GA at five years of age. *Neonatology*, 106(4), 311-316.
<https://doi.org/10.1159/000363216>
- Hamaker, E. L., Kuiper, R. M., & Grasman, R. P. (2015). A critique of the cross-lagged panel model. *Psychological Methods*, 20(1), 102-116.
<https://doi.org/10.1037/a0038889>
- Helland, S. S., Røysamb, E., Wang, M. V., & Gustavson, K. (2018). Language difficulties and internalizing problems: Bidirectional associations from 18 months to 8 years among boys and girls. *Development and Psychopathology*, 30(4), 1239-1252. <https://doi.org/10.1017/S0954579417001559>
- Henrichs, J., Rescorla, L., Schenk, J. J., Schmidt, H. G., Jaddoe, V. W. V., Hofman, A., Raat, H., Verhulst, F. C., & Tiemeier, H. O. (2011). Examining continuity of early expressive vocabulary development: The Generation R Study. *Journal of Speech, Language and Hearing Research*, 54(3), 854-869.
[https://doi.org/10.1044/1092-4388\(2010/09-0255\)](https://doi.org/10.1044/1092-4388(2010/09-0255))
- Hollund-Møllerhaug, L. (2010). Forekomst av språkvankser hos norske barn. *Tidsskrift for Norsk Psykologforening*, 47, 608-610.
- Irgens, L. M. (2000). The Medical Birth Registry of Norway. Epidemiological research and surveillance throughout 30 years. *Acta Obstetrica Gynecologica Scandinavica*, 79(6), 435-439.
<https://doi.org/10.1034/j.1600-0412.2000.079006435.x>

- Irwin, J. R., Carter, A. S., & Briggs-Gowan, M. J. (2002). The social-emotional development of "late-talking" toddlers. *Journal of the American Academy of Child & Adolescent Psychiatry*, 41(11), 1324-1332.
<https://doi.org/10.1097/00004583-200211000-00014>
- Jin, F., Schjølberg, S., Wang, M. V., Eadie, P., Nes, R. B., Røysamb, E., & Tambs, K. (2020). Predicting literacy skills at 8 years from preschool language trajectories: A population-based cohort study. *Journal of Speech, Language and Hearing Research*, 63(8), 2752-2762.
https://doi.org/10.1044/2020_JSLHR-19-00286
- Kilpatrick, T., Leitão, S., & Boyes, M. (2019). Mental health in adolescents with a history of developmental language disorder: The moderating effect of bullying victimisation. *Autism & Developmental Language Impairments*, 4.
<https://doi.org/10.1177%2F2396941519893313>
- Kim, M. J., Catalano, R. F., Haggerty, K. P., & Abbott, R. D. (2011). Bullying at elementary school and problem behaviour in young adulthood: A study of bullying, violence and substance use from age 11 to age 21. *Criminal Behaviour and Mental Health*, 21(2), 136-144. <https://doi.org/10.1002/cbm.804>
- Knox, E., & Conti-Ramsden, G. (2003). Bullying risks of 11-year-old children with specific language impairment (SLI): Does school placement matter? *International Journal of Language and Communication Disorders*, 38(1), 1-12.
<https://doi.org/10.1080/13682820304817>
- Knox, E., & Conti-Ramsden, G. (2007). Bullying in young people with a history of specific language impairment (SLI). *Educational and Child Psychology*, 24(4), 130-141
- Kochenderfer, B. J., & Ladd, G. W. (1996). Peer victimization: Cause or consequence of school maladjustment? *Child Development*, 67(4), 1305-1317.
<https://doi.org/10.1111/j.1467-8624.1996.tb01797.x>
- Kochenderfer-Ladd, B., & Wardrop, J. L. (2001). Chronicity and instability of children's peer victimization experiences as predictors of loneliness and social satisfaction trajectories. *Child Development*, 72(1), 134-151.
<https://doi.org/10.1111/1467-8624.00270>
- Ladd, G. W., Ettekal, I., & Kochenderfer-Ladd, B. (2017). Peer victimization trajectories from kindergarten through high school: Differential pathways for children's school engagement and achievement? *Journal of Educational Psychology*, 109(6), 826-841. <https://doi.org/doi:10.1037/edu0000177>
- Le, H. N., Mensah, F., Eadie, P., McKean, C., Sciberras, E., Bavin, E. L., Reilly, S., & Gold, L. (2020). Health-related quality of life of children with low language from early childhood to adolescence: Results from an Australian longitudinal population-based study. *Journal of Child Psychology and Psychiatry*.
<https://doi.org/10.1111/jcpp.13277>
- Lereya, S. T., Copeland, W. E., Zammit, S., & Wolke, D. (2015). Bully/victims: A longitudinal, population-based cohort study of their mental health. *European Child and Adolescent Psychiatry*, 24(12), 1461-1471.
<https://doi.org/10.1007/s00787-015-0705-5>

- Liu, Y., Mendonca, M., Johnson, S., O'Reilly, H., Bartmann, P., Marlow, N., & Wolke, D. (2019). Testing the neurodevelopmental, trauma and developmental risk factor models of psychosis using a naturalistic experiment. *Psychological Medicine*, 1-10. <https://doi.org/10.1017/S0033291719003349>
- Longobardi, E., Spataro, P., Frigerio, A., & Rescorla, L. (2016). Language and social competence in typically developing children and late talkers between 18 and 35 months of age. *Early Child Development and Care*, 186(3), 436-452. <https://doi.org/10.1080/03004430.2015.1039529>
- Lyytinen, P., Poikkeus, A.-M., Leiwo, M., Ahonen, T., & Lyytinen, H. (1996). Parents as informants of their child's vocal and early language development. *Early Child Development and Care*, 15-25. <https://doi.org/10.1080/0300443961260102>
- Magnus, P., Birke, C., Vejrup, K., Haugan, A., Alsaker, E., Daltveit, A. K., Handal, M., Haugen M., Høiseith, G., Knutsen, G. P., Paltiel, L., Schreuder, P., Tambs, K., Vold, L., & Stoltenberg, C. (2016). Cohort profile update: The Norwegian Mother and Child Cohort Study (MoBa). *International Journal of Epidemiology*, 45(2), 382-388. <https://doi.org/10.1093/ije/dyw029>
- McCabe, P. C., & Meller, P. J. (2004). The relationship between language and social competence: How language impairment affects social growth. *Psychology in the Schools*, 41(3), 313-321. <https://doi.org/10.1002/pits.10161>
- McCartney, K., & Rosenthal, R. (2000). Effect size, practical importance, and social policy for children. *Child Development*, 71(1), 173-180. <https://doi.org/10.1111/1467-8624.00131>
- McCormack, J., Harrison, L. J., McLeod, S., & McAllister, L. (2011). A nationally representative study of the association between communication impairment at 4-5 years and children's life activities at 7-9 years. *Journal of Speech, Language, and Hearing Research*, 54(5), 1328-1348. [https://doi.org/10.1044/1092-4388\(2011/10-0155\)](https://doi.org/10.1044/1092-4388(2011/10-0155))
- McKean, C., Wraith, D., Eadie, P., Cook, F., Mensah, F., & Reilly, S. (2017). Subgroups in language trajectories from 4 to 11 years: the nature and predictors of stable, improving and decreasing language trajectory groups. *Journal of Child Psychology and Psychiatry*, 58(10), 1081-1091. <https://doi.org/10.1111/jcpp.12790>
- Muthén, L. K., & Muthén, B. O. (2017). *Mplus user's guide*. 8th Edition. Los Angeles, CA: Muthén & Muthén.
- Nilsen, R. M., Vollset, S. E., Gjessing, H. K., Skjaerven, R., Melve, K. K., Schreuder, P., Alsaker E. R., Haug, K., Daltveit, A. K., & Magnus, P. (2009). Self-selection and bias in a large prospective pregnancy cohort in Norway. *Paediatric Perinatal Epidemiology*, 23(6), 597-608. <https://doi.org/10.1111/j.1365-3016.2009.01062.x>
- Norbury, C. F., Gooch, D., Wray, C., Baird, G., Charman, T., Simonoff, E., Vamvakas, G., & Pickles, A. (2016). The impact of nonverbal ability on prevalence and clinical presentation of language disorder: evidence from a

- population study. *Journal of Child Psychology and Psychiatry*, 57(11), 1247-1257. <https://doi:10.1111/jcpp.12573>
- Oncioiu, S. I., Orri, M., Boivin, M., Geoffroy, M. C., Arseneault, L., Brendgen, M., Vitaro, F., Navarro, M. C., Galéra, C., Tremblay, R. E., & Cote, S. M. (2020). Early childhood factors associated with peer victimization trajectories from 6 to 17 years of age. *Pediatrics*, 145(5). <https://doi.org/10.1542/peds.2019-2654>
- Ottem, E. (2009). 20 spørsmål om språkferdigheter—en analyse av sammenhengen mellom observasjonsdata og testdata. *Skolepsykologi*, 1, 11-27.
- Pepler, D., Jiang, D., Craig, W., & Connolly, J. (2008). Developmental trajectories of bullying and associated factors. *Child Development*, 79(2), 325-338. <https://doi.org/10.1111/j.1467-8624.2007.01128.x>
- Putnick, D. L., Bornstein, M. H., Eryigit-Madzwamuse, S., & Wolke, D. (2017). Long-term stability of language performance in very preterm, moderate-late preterm, and term children. *Journal of Pediatrics*, 181, 74-79. <https://doi.org/10.1016/j.jpeds.2016.09.006>
- Redmond, S. M. (2011). Peer victimization among students with specific language impairment, attention-deficit/hyperactivity disorder, and typical development. *Language Speech Hearing Services in School*, 42(4), 520-535. [https://doi.org/10.1044/0161-1461\(2011/10-0078\)](https://doi.org/10.1044/0161-1461(2011/10-0078))
- Rennecke, L., Ronniger, P., Petermann, F., & Melzer, J. (2019). Developmental language disorder: Maternal stress level and behavioural difficulties of children with expressive and mixed receptive-expressive DLD. *Journal of Communication Disorders*, 80, 1-10. <https://doi.org/10.1016/j.jcomdis.2019.03.006>
- Rennecke, L., Ronniger, P., Petermann, F., & Melzer, J. (2020). History of bullying and victimisation behaviour of children with language disorders and maternal burden. *International Journal of Disability, Development and Education*, <https://doi.org/10.1080/1034912X.2020.1738010>
- Ribeiro, L.A., Zachrisson, H.D., Schjølberg, S. Aase, H., Rohrer-Baumgartner, N., & Magnus, P. (2011). Attention problems and language development in preterm low-birth weight children: Cross-lagged relations from 18 to 36 months. *BMC Pediatrics* 11(1), 59. <https://doi.org/10.1186/1471-2431-11-59>
- Rice, M. L., Sell, M. A., & Hadley, P. A. (1991). Social interactions of speech- and language-impaired children. *Journal of Speech Language and Hearing Research*, 34(6), 1299-1307. <https://doi.org/10.1044/jshr.3406.1299>
- Richter, J., & Janson, H. (2007). A validation study of the Norwegian version of the Ages and Stages Questionnaires. *Acta Paediatrica*, 96(5), 748-752. <https://doi.org/10.1111/j.1651-2227.2007.00246.x>
- Rodkin, P. C., Espelage, D. L., & Hanish, L. D. (2015). A relational framework for understanding bullying: Developmental antecedents and outcomes. *American Psychologist*, 70(4), 311-321. <https://doi.org/10.1037/a0038658>
- Rutter, M., & Mawhood, L. (1991). *The long term sequelae of specific developmental disorders of speech and language*. In Rutter & Casaer (Eds), *Biological risk factors in childhood psychopathology*: Cambridge University Press.

- Shakoor, S., Jaffee, S. R., Andreou, P., Bowes, L., Ambler, A. P., Caspi, A., Moffitt, T. E., & Arseneault, L. (2011). Mothers and children as informants of bullying victimization: Results from an epidemiological cohort of children. *Journal of Abnormal Child Psychology*, *39*(3), 379-387. <https://doi.org/10.1007/s10802-010-9463-5>
- Solberg, M. E., & Olweus, D. (2003). Prevalence estimation of school bullying with the Olweus Bully/Victim Questionnaire. *Aggressive Behavior*, *29*(3), 239-268. <https://doi.org/10.1002/ab.10047>
- Squires, J., Bricker, D., & Potter, L. (1997). Revision of a parent-completed development screening tool: Ages and Stages Questionnaires. *Journal of Pediatric Psychology*, *22*(3), 313-328. <https://doi.org/10.1093/jpepsy/22.3.313>
- St Clair, M. C., Pickles, A., Durkin, K., & Conti-Ramsden, G. (2011). A longitudinal study of behavioral, emotional and social difficulties in individuals with a history of specific language impairment (SLI). *Journal of Communication Disorders*, *44*(2), 186-199. <https://doi.org/10.1016/j.jcomdis.2010.09.004>
- Stene-Larsen, K., Brandlistuen, R. E., Lang, A. M., Landolt, M. A., Latal, B., & Vollrath, M. E. (2014). Communication impairments in early term and late preterm children: A prospective cohort study following children to age 36 months. *Journal of Pediatrics*, *165*(6), 1123-1128. <https://doi.org/10.1016/j.jpeds.2014.08.027>
- Stowe, R. M., Arnold, D. H., & Ortiz, C. (1999). Gender differences in the relationship of language development to disruptive behavior and peer relationships in preschoolers. *Journal of Applied Developmental Psychology*, *20*(4), 521-536. [https://doi.org/10.1016/S0193-3973\(99\)00024-6](https://doi.org/10.1016/S0193-3973(99)00024-6)
- Tomarken, A. J., & Waller, N. G. (2005). Structural equation modeling: strengths, limitations, and misconceptions. *Annual Review of Clinical Psychology*, *1*, 31-65. <https://doi.org/10.1146/annurev.clinpsy.1.102803.144239>
- Tomblin, J. B., & Zhang, X. (2006). The dimensionality of language ability in school-age children. *Journal of Speech, Language and Hearing Research*, *49*(6), 1193-1208. [https://doi.org/10.1044/1092-4388\(2006\)086](https://doi.org/10.1044/1092-4388(2006)086)
- Unnever, J. D., & Cornell, D. G. (2003). Bullying, self-control, and ADHD. *Journal of Interpersonal Violence*, *18*(2), 129-147. <https://doi.org/10.1177/0886260502238731>
- Vallotton, C., & Ayoub, C. (2011). Use Your Words: The Role of Language in the Development of Toddlers' Self-Regulation. *Early Childhood Research Quarterly*, *26*(2), 169-181. <https://doi.org/10.1016/j.ecresq.2010.09.002>
- van den Bedem, N. P., Dockrell, J. E., van Alphen, P. M., Kalicharan, S. V., & Rieffe, C. (2018). Victimization, bullying, and emotional competence: Longitudinal associations in (pre)adolescents with and without developmental language disorder. *Journal of Speech, Language and Hearing Research*, *61*(8), 2028-2044. https://doi.org/10.1044/2018_JSLHR-L-17-0429
- van der Wilt, F., van der Veen, C., van Kruistum, C., & van Oers, B. (2020). Language Abilities and Peer Rejection in Kindergarten: A Mediation Analysis. *Early*

- Education and Development*, 31(2), 308-322.
<https://doi.org/10.1080/10409289.2019.1624145>
- van Daal, J., Verhoeven, L., & van Balkom, H. (2007). Behaviour problems in children with language impairment. *Journal of Child Psychology and Psychiatry*, 48(11), 1139-1147. <https://doi.org/10.1111/j.1469-7610.2007.01790.x>
- Verlinden, M., Jansen, P. W., Veenstra, R., Jaddoe, V. W., Hofman, A., Verhulst, F. C., Shaw, P., & Tiemeier, H. (2015). Preschool attention-deficit/hyperactivity and oppositional defiant problems as antecedents of school bullying. *Journal of the American Academy of Child and Adolescent Psychiatry*, 54(7), 571-579. <https://doi.org/10.1016/j.jaac.2015.05.002>
- Vlachou, M., Andreou, E., Botsoglou, K., & Didaskalou, E. (2011). Bully/victim problems among preschool children: A review of current research evidence. *Educational Psychology Review*, 23(3), 329-358. <https://doi.org/10.1007/s10648-011-9153-z>
- Wang, M. V., Aarø, L. E., & Ystrøm, E. (2018). Language delay and externalizing problems in preschool age: A prospective cohort study. *Journal of Abnormal Child Psychology*, 46(5), 923-933. <https://doi.org/10.1007/s10802-017-0391-5>
- Wendelborg, C. (2020). *Mobbing og arbeidsro i skolen-Analyse av Elevundersøkelsen skoleåret 2019/20*. NTNU Samfunnsforskning Mangfold og Inkludering. <https://samforsk.no/Sider/Publikasjoner/Mobbing-og-arbeidsro-i-skolen--Analyse-av-Elevunders%C3%B8kelsen-skole%C3%A5ret-20192020.aspx>
- Winsler, A., De Leon, J. R., Wallace, B. A., Carlton, M. P., & Willson-Quayle, A. (2003). Private speech in preschool children: Developmental stability and change, across-task consistency, and relations with classroom behaviour. *Journal of Child Language*, 30(3), 583-608. <https://doi.org/10.1017/S0305000903005671>
- Wolke, D., Baumann, N., Strauss, V., Johnson, S., & Marlow, N. (2015). Bullying of preterm children and emotional problems at school age: Cross-culturally invariant effects. *Journal of Pediatrics*, 166(6), 1417-1422. <https://doi.org/10.1016/j.jpeds.2015.02.055>
- Wolke, D., Copeland, W. E., Angold, A., & Costello, E. J. (2013). Impact of bullying in childhood on adult health, wealth, crime, and social outcomes. *Psychological Science*, 24(10), 1958-1970. <https://doi.org/10.1177/0956797613481608>
- Wolke, D., & Lereya, S. T. (2015). Long-term effects of bullying. *Archives of Disease in Childhood*, 100(9), 879-885. <https://doi.org/10.1136/archdischild-2014-306667>
- Wolke, D., Samara, M., Bracewell, M., & Marlow, N. (2008). Specific language difficulties and school achievement in children born at 25 weeks of gestation or less. *Journal of Pediatrics*, 152(2), 256-262. <https://doi.org/10.1016/j.jpeds.2007.06.043>
- Wolke, D., Waylen, A., Samara, M., Steer, C., Goodman, R., Ford, T., & Lamberts, K. (2009). Selective drop-out in longitudinal studies and non-biased prediction of behaviour disorders. *British Journal of Psychiatry*, 195(3), 249-256. <https://doi.org/10.1192/bjp.bp.108.053751>

- Wolke, D., Woods, S., & Samara, M. (2009). Who escapes or remains a victim of bullying in primary school? *British Journal of Developmental Psychology*, 27, 835-851. <https://doi.org/10.1348/026151008X383003>
- Wolke, D., Woods, S., Stanford, K., & Schulz, H. (2001). Bullying and victimization of primary school children in England and Germany: Prevalence and school factors. *British Journal of Psychology*, 92(Pt 4), 673-696. <https://doi.org/10.1348/000712601162419>
- Xia, Y., & Yang, Y. (2019). RMSEA, CFI, and TLI in structural equation modeling with ordered categorical data: The story they tell depends on the estimation methods. *Behavior Research Methods*, 51(1), 409-428. <https://doi.org/10.3758/s13428-018-1055-2>
- Zambrana, I. M., Pons, F., Eadie, P., & Ystrøm, E. (2014). Trajectories of language delay from age 3 to 5: Persistence, recovery and late onset. *International Journal of Language and Communication Disorders*, 49(3), 304-316. <https://doi.org/10.1111/1460-6984.12073>
- Zubrick, S. R., Taylor, C. L., Rice, M. L., & Slegers, D. W. (2007). Late language emergence at 24 months: an epidemiological study of prevalence, predictors, and covariates. *Journal of Speech, Language and Hearing research*, 50(6), 1562-1592. [https://doi.org/10.1044/1092-4388\(2007/106\)](https://doi.org/10.1044/1092-4388(2007/106))
- Øksendal, E., Brandlistuen, R. E., Holte, A., & Wang, M. V. (2019). Peer-victimization of young children with developmental and behavioral difficulties—a population-based study. *Journal of Pediatric Psychology*, 44(5), 589- 600. <https://doi.org/10.1093/jpepsy/jsy112>

Table 1 Descriptive statistics for the different developmental paths of language difficulties

	Reference group n=20 549 (93.2%)	Persistent language difficulties n=461 (2.1%)	Transient language difficulties n=347 (1.6%)	Late onset language difficulties n=691 (3.1%)
Gender	9899 (48.3%)	325 (70.5%)	239 (69.1%)	396 (57.3%)
boy/girl	10614 (51.7%)	136 (29.5%)	107 (30.9%)	295 (42.7%)
Lower education M	3944 (19.2%)	137 (29.7%)	118 (34.0%)	192 (27.8%)
Lower education F	5417 (26.4%)	172 (37.3%)	125 (36.0%)	215 (31.1%)
Lower income	3314 (16.4%)	107 (23.8%)	67 (19.8%)	135 (19.9%)
Premature gestational age < 37 weeks	1059 (5.3%)	49 (10.8%)	26 (7.7%)	41 (6.1%)
Stable emotional difficulties	83 (0.4%)	17 (3.7%)	6 (1.7%)	15 (2.2%)
Stable behavioral difficulties	124 (0.6%)	25 (5.4%)	7 (2.0%)	13 (1.9%)
Stable attention difficulties/hyperactivity	131 (0.6%)	66 (14.4%)	4 (1.2%)	17 (2.5%)
Poor fine motor skills 3 years	598 (2.9%)	80 (17.6%)	38 (11.0%)	28 (4.1%)
Poor gross motor skills 3 years	530 (2.6%)	77 (16.7%)	27 (7.8%)	32 (4.6%)
Peer-victimization 5 years	580 (2.8%)	62 (13.6%)	29 (8.4%)	40 (5.9%)
Peer-victimization 8 years	1306 (6.4%)	76 (16.8%)	34 (9.9%)	91 (13.2%)
Peer-victimization 5 and 8 years	145 (0.7%)	21 (4.7%)	8 (2.3%)	15 (2.2%)
Bully-perpetration 8 years	413 (2.0%)	25 (5.6%)	12 (3.5%)	26 (3.9%)

Note. Persistent language difficulties = difficulties at three, five and eight years. Transient language difficulties = difficulties at only three and five years. Late onset language difficulties = difficulties at only eight years. M = mothers, F = fathers. “Lower education” and “lower income” corresponded to the lowest ~ 20% of the sample. Stable emotional difficulties corresponded to estimates within the 90th percentile (indicating difficulties) on three items from the Child Behavior Checklist (CBCL) and two items from the Infant-Toddler Social and Emotional Assessment at three years, five items from CBCL at five years, and five items from the Screen for Child Anxiety Related Emotional Disorders and 13 items from The Short Mood and Feelings Questionnaire at eight years. Stable attention difficulties corresponded to estimates within the 90th percentile (indicating difficulties) on four items from CBCL at three years, 12 items from the Conner’s Parent Rating Scale-Revised at five years and 18 items from the Parent/Teacher Rating Scale for Disruptive Behavior Disorders (RS-DBD) at eight years. Stable behavioral difficulties corresponded to estimates within the 90th percentile (indicating difficulties) on seven items from CBCL at three and five years, and eight items from RS-DBD at eight years. Poor motor skills corresponded to estimates within the 95th percentiles (indicating difficulties) on two items measuring gross motor skills and two items measuring fine motor skills at three years from Ages and Stages Questionnaires.

Table 2 Descriptive statistics for children with mild language difficulties

	Reference group n=11 351 (94.6%)	Mild language difficulties n=650 (5.4%)
Gender		
boy/girl	5161 (45.5%) 6172 (54.5%)	362 (55.7%) 288 (44.3%)
Lower education M	1932 (17.0%)	169 (26.0%)
Lower education F	2792 (24.6%)	203 (31.2%)
Lower income	1701 (15.3%)	125 (19.5%)
Premature gestational age<37 weeks	551 (5.0%)	41 (6.4%)
Stable emotional difficulties	23 (0.2%)	8 (1.2%)
Stable behavioral difficulties	47 (0.4%)	12 (1.8%)
Stable attention difficulties/hyperactivity	38 (0.3%)	15 (2.3%)
Poor fine motor skills 3 years	258 (2.3%)	36 (5.6%)
Poor gross motor skills 3 years	248 (2.2%)	36 (5.6%)
Peer-victimization 5 years	251 (2.2%)	37 (5.7%)
Peer-victimization 8 years	602 (5.3%)	61 (9.4%)
Peer-victimization 5 and 8 years	55 (0.5%)	8 (1.2%)
Bully-perpetration 8 years	180 (1.6%)	20 (3.1%)

Note. Mild language difficulties are children with measures between ~ 80th and 90th percentile (indicating mild difficulties) at three, five and eight years. M = mothers, F = fathers. “Lower education” and “lower income” corresponded to the lowest ~ 20% of the sample. Stable emotional difficulties corresponded to estimates within the 90th percentile (indicating difficulties) on three items from the Child Behavior Checklist (CBCL) and two items from the Infant-Toddler Social and Emotional Assessment at three years, five items from CBCL at five years, and five items from the Screen for Child Anxiety Related Emotional Disorders and 13 items from The Short Mood and Feelings Questionnaire at eight years. Stable attention difficulties corresponded to estimates within the 90th percentile (indicating difficulties) on four items from CBCL at three years, 12 items from the Conner’s Parent Rating Scale-Revised at five years and 18 items from the Parent/Teacher Rating Scale for Disruptive Behavior Disorders (RS-DBD) at eight years. Stable behavioral difficulties corresponded to estimates within the 90th percentile (indicating difficulties) on seven items from CBCL at three and five years, and eight items from the RS-DBD at eight years. Poor motor skills corresponded to estimates within the 95th percentiles (indicating difficulties) on two items measuring gross motor skills and two items measuring fine motor skills at three years from Ages and Stages Questionnaires.

Table 3 Unadjusted polychoric correlations between language skills, peer-victimization, bully-perpetration and gender at different time points

	Language skills 3 years	Language skills 5 years	Language skills 8 years	Peer- victimization 5 years	Peer- victimization 8 years	Bully- perpetration 8 years	Gender 1=boy 2=girl
Language skills 3 years	1	.661 (p<.001)	.608 (p<.001)	.218 (p<.001)	.102 (p<.001)	.069 (p<.001)	-.200 (p<.001)
Language skills 5 years		1	.756 (p<.001)	.300 (p<.001)	.173 (p<.001)	.143 (p<.001)	-.167 (p<.001)
Language skills 8 years			1	.262 (p<.001)	.185 (p<.001)	.152 (p<.001)	-.124 (p<.001)
Peer- Victimization 5 years				1	.375 (p<.001)	.211 (p<.001)	-.147 (p<.001)
Peer- victimization 8 years					1	.668 (p<.001)	-.078 (p<.001)
Bully- perpetration 8 years						1	-.203 (p<.001)
Gender 1=boy 2=girl							1

Note. Language skills are measured with latent variables. High scores indicate poor language skills. Peer-victimization, bully-perpetration and gender are measured with observed variables.

Table 4 Crude and adjusted odds ratio (95% confidence intervals) of peer-victimization measured at five and eight years, and bully-perpetration measured at eight years for children with different paths of language difficulties and mild language difficulties, as opposed to having no language difficulties

	Peer-victimization five years OR (95% CI)		Peer-victimization eight years OR (95% CI)		Peer-victimization five and eight years OR (95% CI)		Bully-perpetration eight years OR (95% CI)	
	Crude	Adjusted	Crude	Adjusted	Crude	Adjusted	Crude	Adjusted
Persistent language difficulties (A)	5.37 (4.06–7.11) ***	4.88 (3.67–6.49) ***	2.96 (2.30–3.81) ***	2.92 (2.26–3.76) ***	6.84 (4.28–10.91) ***	6.60 (4.10–10.61) ***	2.84 (1.87–4.29) ***	2.53 (1.67–3.85) ***
Transient language difficulties (A)	3.13 (2.12–4.63) ***	2.96 (2.00–4.38) ***	1.61 (1.12–2.30) **	1.56 (1.08–2.25) *	3.33 (1.62–6.84) ***	3.27 (1.59–6.75) ***	1.75 (.98–3.14) No sig	1.46 (.79–2.69) No sig
Late onset language difficulties (A)	2.13 (1.53–2.96) ***	2.12 (1.52–2.95) ***	2.24 (1.78–2.81) ***	2.18 (1.73–2.75) ***	3.14 (1.84–5.37) ***	3.25 (1.89–5.58) ***	1.93 (1.29–2.89) ***	1.91 (1.27–2.86) **
Mild language difficulties (B)	2.68 (1.88–3.82) ***	2.61 (1.83–3.73) ***	1.85 (1.40–2.44) ***	1.80 (1.36–2.38) ***	2.57 (1.22–5.41) *	2.60 (1.23–5.52) *	1.97 (1.24–3.16) **	1.91 (1.19–3.06) **

Note. OR=Odds ratio, CI=Confidence intervals. OR crude and adjusted for gender and gestational age at birth<37 weeks. Persistent language difficulties=difficulties at three, five and eight years. Transient language difficulties=difficulties at only three and five years. Late onset language difficulties are difficulties at only eight years. Mild language difficulties=measures within approximately the 80th and 90th percentile at three, five and eight years. A=reference group includes children with no language difficulties at three, five and eight years. B=reference group includes children with no language difficulties or mild language difficulties at three, five and eight years. *p ≤ .05, **p ≤ .01, ***p ≤ .001.

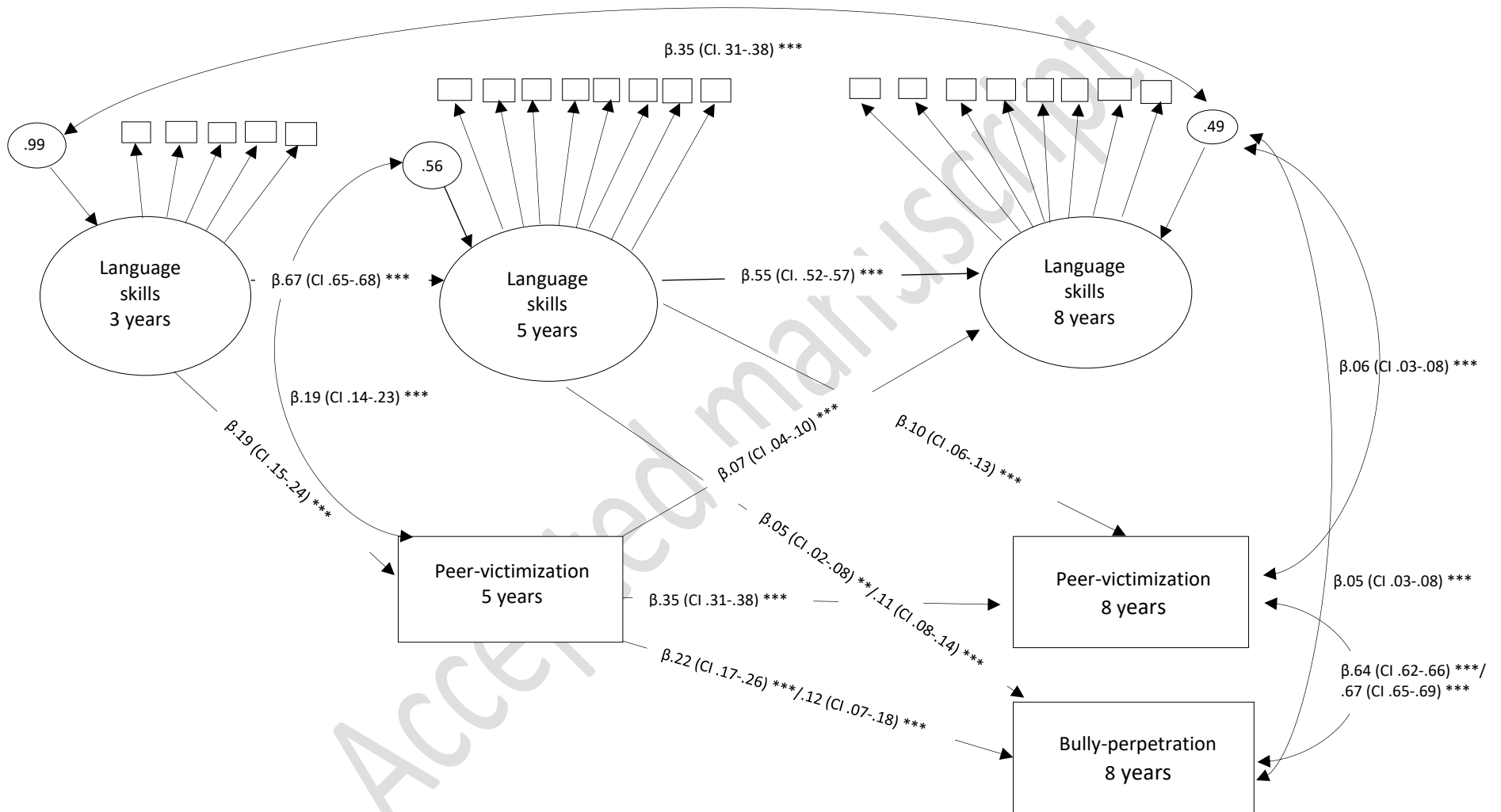


Figure 1 Structural equation model of language skills measured at three, five and eight years, peer-victimization at five and eight years and bully-perpetration at eight years (boys/girls). Language skills are measured with latent variables. High scores indicate poor language skills. Standardized results with 95% confidence intervals (CI) are shown. Results are adjusted for child's age at each measurement point and gestational age at birth < 37 weeks. The root mean square error of approximation was .025, comparative fit index was .983 and Tucker-Lewis Index was .980. Our results show good model fit. * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.