

Developmental Associations Between Conduct Problems and Expressive Language in Early Childhood: A Population-Based Study

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Abstract Conduct problems have been associated with poor language development, however the direction of this association in early childhood remains unclear. This study examined the longitudinal directional associations between conduct problems and expressive language ability. Children enrolled in the UK Millennium Cohort Study ($N = 14,004$; 50.3 % boys) were assessed at 3 and 5 years of age. Parent reports of conduct problems and standardised assessments of expressive language were analyzed using cross-lagged modeling. Conduct problems at 3 years was associated with poorer expressive language at 5 years and poorer expressive language at 3 years was associated with increased conduct problems by 5 years. The results support reciprocal associations, rather than a specific unidirectional path, which is commonly found with samples of older children. The emergence of problems in either domain can thus negatively impact upon the other over time, albeit the effects were modest. Studies examining the effects of intervention targeting conduct problems and language acquisition prior to school entry may be warranted in

testing the efficacy of prevention programmes related to conduct problems and poor language ability early in childhood.

Keywords Conduct problems · Expressive language · Early childhood · Millennium Cohort Study

The acquisition of language in infancy is dependent on the social learning environment and the quality of communicative experiences, achieved primarily through interactions between the parent and child (Bruner 1984; Hoff 2006). That is, toddlers begin to develop language through imitation, listening to others, and direct instruction (Hoff 2006). If opportunities for engagement in multiple verbal turn-taking interactions are less frequent, or there is a lack of cognitive stimulation for the child, poorer language ability may result. Children engaged in early displays of conduct problems may thus experience a reduced language rich environment as parents focus on reduc-

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ing negative behaviours at the potential expense of language development (Dionne et al. 2003).

Conversely, children with delayed or impaired language acquisition may lack the ability to express themselves through verbal outlets, potentially resulting in elevated frustration and engagement in conduct related behaviours as an alternative form of communication (Cole et al. 2010). For example, early social situations are often characterized by the verbal exchange of wants, needs, sharing of feelings, and emotional states. Physical actions such as temper tantrums or aggressive behaviours may act as a replacement of this expression when children's vocabulary is under developed. Forms of verbal exchanges are highly important for children's social development and in building effective strategies for resolving conflict during social interactions (Rhee et al. 2013). Empirical studies with clinical samples have supported such negative associations between conduct problems and language acquisition in childhood and adolescence (Botting and Conti-Ramsden 2000; Brownlie et al. 2004; Giddan et al. 1996; van Daal et al. 2007).

While direct associations between conduct problems and language have been found, the emergence of either conduct problems or poor expressive language in the late toddler years may also be dependent on other factors such as parenting behaviours and child characteristics. For example, the theoretical perspective for the association from conduct problems to poorer language ability is largely contingent upon the stimulation and types of interactions that children receive from their environment and more specifically from their parents. Harsh parenting has been implicated with elevated externalizing behaviours problems, and to a lesser extent, with poorer language outcomes (Del Vecchio et al. 2014; Pungello et al. 2009; Scaramella and Leve 2004).

Additionally, studies have found that parental warmth and positive parent-child interactions fosters language growth (Hann et al. 1996) and has modest impacts on the reduction of problematic behaviours (Gardner et al. 2007). In the case of language, positive parenting can create engaging and safe environments for exploration in which children feel comfortable in expressing their needs and posing questions. This may consequently lead to more frequent dyadic exchanges, which can promote language development through richer opportunities for communication and an analyzable language model; both of which are required for children to develop language (Hoff 2006). The impact of such parenting behaviours, especially in infancy and toddlerhood, on social and linguistic learning is not surprising given that children primarily gain knowledge and experience of the world during social interactions with parents (Bruner 1982). Learning then occurs through imitation, modeling, and subsequently reinforcement. However, the magnitude of the effect of parenting behaviours across developmental domains is not always consistent. Thus, it is important to partial out any variance that parenting factors

may contribute towards either conduct problems or expressive language.

From the available literature, possible comorbid externalizing behaviours such as hyperactivity, in addition to cognitive ability, and the children's sex are also candidates that may contribute directly to the emergence of either conduct problems or language ability. For example, a review of prominent risk factors for conduct problems across multiple epidemiological studies placed both hyperactivity and a low IQ among the greatest individual risk factors longitudinally, with overall prevalence rates lower among girls than boys (Murray and Farrington 2010). Associations between language ability, IQ, and sex have also been found (Rose et al. 2009; Yew and O'Kearney 2013).

The current literature is however limited in two important ways. First, with a few notable exceptions (e.g., Dionne et al. 2003; Girard et al. 2014; Oliver et al. 2004; Silva et al. 1987; Stevenson and Richman 1978), studies have not focused on the directional associations between conduct related problems and language acquisition commencing as early as the toddler years. This is an important limitation given previous research suggesting that the associations between language ability and externalizing problems are more common in the earlier years, while the associations between language and internalizing behaviours are more prevalent in older children (Gallagher 1999).

From a developmental perspective, it is between the 2nd and 4th years of life when toddlers undergo very rapid vocabulary spurts (Rose et al. 2009). It is also during this period when more frequent conduct related behaviours such as tantrums and aggression start to emerge. The literature shows that an increase in severe temper tantrums and aggression often occurs around the 2nd and 3rd years respectively, followed by a decline in a large majority of children around the 4th to 5th years (Alink et al. 2006; Tremblay 2010). Given that the period between 3 and 5 years of age is implicated in the developmental trajectories of both language acquisition and conduct related problems, we may expect to find associations emerging during this period. Thus, there is a need for studies to examine the directional associations between language ability and conduct problems commencing in the late toddler years when these associations may start to present.

A second notable limitation of this literature relates to the limited number of studies that have examined these associations using large cohorts sampled from the general population. The high reliance on, and the use of smaller clinical samples in previous work, may overestimate the magnitude of associations between conduct problems and language given potential issues related to higher comorbidity within these populations. This may lead to potential differences in the effect size; in addition the direction of the association may present differently. For example, a recent population-based Canadian cohort study found only modest associations between language

ability and aggression up to 41 months with the direction of association changing over time. However, it was suggested that these associations were likely to be more indicative of parallel, rather than predictive associations, with the onset of problems in both domains being more dependent on other factors such as parenting behaviours (Girard et al. 2014). Population-based samples are also useful as the pool of participants to sample from is larger (advantageous from a statistical perspective) and facilitates the examination of the association in children with lower levels of risk (advantageous from a practical perspective). Thus, there is a need for studies using large scale population cohorts to test whether associations between conduct problems and language generalize to the general pediatric population.

Objectives

The current study estimated the cross-lagged associations between conduct problems and expressive language from 3 to 5 years of age in a UK birth cohort. As there is increased interest in the evaluation of the cost benefit ratio for early preventative efforts (e.g., Doyle et al. 2009; Heckman et al. 2010), a clearer understanding of the directional nature of this association in early childhood would help identify the targets and benefits of potential interventions. Longitudinal designs commencing in the early years of development are thus necessary to better understand whether early displays of conduct problems place children at increased risk in their language acquisition or whether children with poorer language development are at increased risk of future conduct problems.

As poorer language abilities can impinge on the use of verbal strategies for communication, potentially resulting in reliance on negative behavioural forms of communication such as temper tantrums and aggressive behaviours (Cole et al. 2010), we hypothesized that a negative cross-lagged association from language ability at 3 years of age to conduct problems at 5 years of age would be found. As conduct problems in the early years may cause parents to focus on the child's behavioural problems at the expense of their language learning (Dionne et al. 2003), it was also hypothesized that a negative cross-lagged association would be found from conduct problems at 3 to expressive language at 5. In addition, given the importance of the family environment and within-child characteristics on both conduct problems and language individually, these variables were included as covariates to observe whether the associations between conduct problems and expressive language would hold given their inclusion. While not exhaustive, we controlled for harsh and positive parenting, maternal depression, children's nonverbal cognition, hyperactivity/inattention, and sex (e.g., Asbury et al. 2005; Beitchman et al. 1996, 2001; Derauf et al. 2011; Nozadi et al. 2013; Petrill et al. 2004; Yew and O'Kearney

2013). We expected all associations to hold over and above any direct effects of the control variables on conduct problems and expressive language.

Methods

Participants

Children and their families included in the study were enrolled in the Millennium Cohort Study (MCS). Families who were residents in the UK (England, Wales, Scotland, and Northern Ireland) with infants born between 2000 and 2002 and who were eligible for child benefits were invited to participate in the MCS. Child benefit is a universal payment scheme in the UK whereby all parents or guardians responsible for the care of a child under the age of 16 receive monetary payments.¹ Two exceptions to this are families whose residency status is either temporary or uncertain. The Department of Work and Pensions (DWP), now the Department of Social Security, sent letters to all eligible families detailing the purpose of the overall MCS and inviting them to participate (Shaw and Calderwood 2004). Families who did not wish to take part could opt-out by telephoning or by writing to the DWP. The field response rate in the first wave of the study at 9 months was documented in the technical report of the MCS1 as 81 % ($N = 18,553$). Given the inherent attrition typical in longitudinal studies, the present study included children who had data on conduct problems and expressive language (wave 2 and 3) which resulted in $N = 14,004$ (75.5 % of the families that were enrolled in wave 1). The sample included 7,049 boys (i.e., 50.3 %). Demographic characteristics for the entire cohort and those that were included in the present study are presented in Table 1. Attrition analyses were conducted to examine potential differences between the entire cohort and the 14,004 families included in the current study. Chi square tests revealed significant differences between groups on employment at 9 months, $\chi^2(1) = 181.51, p < 0.001$; marital status, $\chi^2(2) = 90.02, p < 0.001$; ethnic group, $\chi^2(2) = 364.20, p < 0.001$; and highest maternal academic qualification, $\chi^2(8) = 453.03, p < 0.001$, whereby the group included in the current study were slightly more advantaged compared to the entire cohort as is common with patterns of attrition in longitudinal studies.

All MCS data is publicly available through the UK Data Archive. Stratification procedures for the cohort are documented extensively elsewhere (Dex and Joshi 2005). The current study used data collected in the first three waves (i.e., 9 months, 3 years, and 5 years of age). All data were collected

¹ Amendments have since been made to the child benefit scheme in the UK, which are now means-tested. As of 2013, eligibility is determined based on family income.

Table 1 Demographic characteristics of the original MCS and families included in the current study

Employment:	Initially recruited (<i>N</i> = 18, 553)	Included in the current study (<i>N</i> = 14, 004)
Employed at 9 months	36.00 %	47.02 %
Marital status:		
Single	42.70 %	31.17 %
Married	49.74 %	61.80 %
Separated/divorced/widow	7.28 %	6.97 %
Ethnic group (% non-white):	22.41 %	15.57 %
Highest academic qualification:		
Higher degree	2.45 %	3.55 %
First degree	7.34 %	13.57 %
Diploma in higher education	5.69 %	9.07 %
A/AS/S Levels	7.64 %	9.67 %
O Level/GCSE grades A-C	32.85 %	33.51 %
(GCSE) grades D-G	11.38 %	10.52 %
Other academic qualification	4.21 %	2.55 %
Maternal age	28.1 (6.03)	30.0 (5.90)

All variables collected when infants were 9 months. GCSE grades D-G is approximately equivalent to having less than a high school diploma in the US education system; O level GCSE grades A-C is an exit qualification from high school taken at 16 years of age however does not qualify the holder to attend university; A/AS/S levels is comparable to a high school diploma; Diploma in higher education is approximately equivalent to a 2-year college degree; First degree is approximately equivalent to a 4-year college degree; Higher degree is approximately equivalent to a graduate/professional degree

during home visits and informed consent was obtained from primary caregivers, typically the mothers. Ethics approval for the primary MCS was obtained from the South West Multi-Centre Research Ethics Committee and the London Multi-Centre Research Ethics Committee.

Measures

Outcomes

Conduct problems were assessed using the Strengths and Difficulties Questionnaire (SDQ) at 3 and 5 years of age. The SDQ was originally normed for children from 5 to 18 years of age (Goodman 1997, 2001); however it has been used and validated with samples as young as 3 years of age (Theunissen et al. 2013). The conduct problems scale included five items: (1) often has temper tantrums, (2) generally obedient (reverse coded), (3) fights with or bullies other children, (4) can be spiteful to others, and (5) often argumentative with adults. In the current sample Cronbach's alpha was 0.82 and 0.78 at 3 and 5 years respectively. Parents were asked to report on a three-point scale whether items were (0) *not true*, (1) *somewhat true*, or (2) *certainly true*. Items were summed to create a score for each child that ranged between 0 and 10 with higher scores indicating more conduct problems. In a cross validation of the individual scales of the SDQ, children scoring above the 90th percentile on the conduct problems scale had a mean odds ratio of 15.2 of an independent psychiatric

diagnosis for conduct or oppositional defiance disorder, thus demonstrating the predictive validity of this scale (Goodman 2001).

Children's language was assessed using the British Ability Scale (BAS), a standardised assessment used for children and adolescents from 3 to 17:11 years of age (Elliot et al. 1996). The BAS early years battery is comprised of six core scales measuring children's verbal ability, non-verbal reasoning ability, and spatial ability. Support for the construct validity of the BAS verbal ability scales was derived in part from the large association with the Wechsler Preschool and Primary Scale of Intelligence-Revised verbal scale (i.e., 0.83; Elliott et al. 1997). In the current study the standardised score of the naming vocabulary scale was used at both 3 and 5 years of age as a measure of children's expressive language. The naming vocabulary scale required children to identify and define objects. Cronbach's alphas for the naming vocabulary have been reported as 0.86 and 0.65 respectively (Elliott et al. 1997). In the current sample Cronbach's alpha was 0.95 and 0.59 at 3 and 5 years respectively.

Covariates

Children's cognitive ability was assessed at 3 years of age using the Bracken School Readiness Assessment - Revised (BSRA-R; Bracken 2002), which has been well validated in the literature (e.g., Panter and Bracken 2009). The BSRA-R is a standardised measure of intelligence normed for children

aged 2:6–6:11 years of age. A composite standardised score from the six scales measuring nonverbal cognition (i.e., colors, letters, numbers and counting, sizes, comparisons, and shapes) was utilised in the current study. Cronbach's alpha in the current sample was 0.89.

Children's hyperactivity/inattention was assessed at 3 years of age using the Strengths and Difficulties Questionnaire. The hyperactivity/inattention scale included five items (e.g., restless, overactive, cannot sit still long, constantly fidgeting or squirming), which were summed to create a score for each child ranging from 0 to 10, with higher scores indicating more problems. Cronbach's alpha in the current sample was 0.81.

Aspects of parenting behaviours were assessed using parent reports and inventories collected during the home visits when children were 3 years of age. Harsh parenting was assessed using parent report. Items came from the Conflict Tactics Scale (Straus and Hamby 1997) and included (1) smack child if being naughty, (2) shout at child if being naughty, (3) send child to bedroom/naughty chair, (4) take away treats if child is naughty, and (5) tell him or her off if being naughty. Parents reported on the frequency of these items as (1) *never*, (2) *rarely*, (3) *once a month*, (4) *once a week or more*, and (5) *daily*. A composite score was then created from the five items. Cronbach's alpha in the current sample was 0.92.

Positive parenting was measured during the home visit using items taken from the Infant Toddler- HOME (Caldwell and Bradley 2001). A trained interviewer recorded the presence or absence (yes/no) of each item which included (1) mother's voice is positive, (2) mother converses at least twice with child, (3) mother answers child's questions verbally, (4) mother praises child spontaneously, and (5) mother caresses or kisses child. A composite score was then created from the five items. Cronbach's alpha was 0.99.

Finally, maternal depression was assessed using eight items that specifically focused on depressive symptoms from the larger Rutter Malaise Inventory (Rutter et al. 1970), an overall measure of psychosocial distress. Maternal reports were collected in the first wave of the study when the infants were 9 months old. Mothers reported on the presence or absence of each item. Example items included (1) felt sad or low, (2) depressed, (3) tired most of the time. A composite score was then created from the eight items. Cronbach's alpha in the current sample was 0.84.

Statistical Analysis

Cross-lagged modeling was employed in the current study. While causality cannot be directly inferred, the use of cross-lagged models is advantageous as it enables the examination of multiple paths without imposing assumptions of directionality (Kenny 1975; Selig and Little 2012). Further, the use of cross-lagged models is particularly valuable when testing

developmental models where change may be expected as the inclusion of the auto-regressive paths partials out previous variance (e.g., Y_2 from Y_1), thus the cross-lagged predictions are estimated from residual variance (Selig and Little 2012). Cross-lagged paths then take into account the initial level of the outcome construct, reducing the likelihood that effects observed across time are merely the result of correlated X_1 and Y_1 variables. To the best of our knowledge, with the exception of one study examining physical aggression and language ability (Girard et al. 2014), no studies to date have examined the associations between children's conduct problems and expressive language using cross-lagged models as compared to multiple regression analyses that inherently impose directionality regarding the associations. Two models were estimated in the current study. The first model estimated the auto-regressive, concurrent, and cross-lagged associations between conduct problems and expressive language at 3 and 5 years of age. In the second model, the same paths were estimated after regressing control variables on both conduct problems and expressive language ability at 3 years of age. As the model became saturated when controls were regressed at age 5, this model was excluded.

The fit indices presented for each model include the chi-square test, the root mean square error of approximation (RMSEA; Browne and Cudeck 1993), the standardised root mean square residual (SRMR; Diamantopoulos and Siguaw 2000), and the comparative fit index (CFI; Bentler 1990). The RMSEA and SRMR are presented as a result of the high likelihood of obtaining a significant chi-square test with very large sample sizes such as in the current study (Hooper et al. 2008). It has been suggested that a RMSEA between 0.05 to 0.08 indicates good to adequate fit and 0.08 to 0.10 indicates mediocre fit (MacCallum et al. 1996). For the SRMR, equal to or lesser than 0.05 represents a good model fit (Diamantopoulos and Siguaw 2000; Hu and Bentler 1999). The CFI was also presented as it has been found to be among the fit indices that is least affected by sample size (Fan et al. 1999). Hu and Bentler (1999) have suggested equal to or greater than 0.95 as representing a good model fit.

Cross-lagged models were estimated using Mplus version 6.11 full information maximum likelihood (FIML; Muthén and Muthén 1998–2011) to account for missing data. Full information maximum likelihood is advantageous as it is a more unbiased method when handling missing data (Enders and Bandalos 2001). Standardised betas (β) are presented as an estimate of effect size. We adopted a more stringent statistical threshold ($\alpha = 0.001$ instead of 0.050, see Johnson 2013) due to the large sample size involved.

Due to saturation in the first model and extremely poor fit indices, the concurrent path at 5 years was removed. Fits for the two models, without and with covariates were good to acceptable, $\chi^2(5) = 7892.79$, $p < 0.001$; RMSEA = 0.052; RMSEA CI₉₀ = 0.039–0.067; SRMR = 0.011; CFI = 0.99,

and $\chi^2(30) = 33,294.05$, $p < 0.001$; RMSEA = 0.087; RMSEA $CI_{90} = 0.084$ – 0.091 ; SRMR = 0.044; CFI = 0.95, respectively. Post-hoc two-group models were also estimated to examine possible differences between boys and girls, however these were not presented, as the associations in each model were similar to the one-group models.

Results

The descriptive statistics and bivariate correlations for conduct problems and expressive language are presented in Table 2. All correlations were in the expected direction whereby higher conduct problems were associated with lower expressive language. Additionally, the bivariate correlations among covariates are presented in Table 3.

Conduct Problems and Expressive Language

Cross-Lagged Model Without Controls

Auto-regressive (e.g., from conduct problems at 3 years to conduct problems at 5 years), concurrent (e.g., between conduct problems and expressive language at 3 years), and cross-lagged paths (e.g., from conduct problems at 3 years to expressive language at 5 years) were examined. Results of the first model are presented in Fig. 1. Auto-regressive standardised paths revealed medium statistically significant positive associations for both conduct problems and expressive language from 3 to 5 years of age. The statistically significant auto-regressive paths support initial conduct problems being predictive of future conduct problems and similarly that early expressive language is predictive of later expressive language. The concurrent standardised path between conduct problems and expressive language at 3 years of age was also statistically significant, suggesting that children who were rated higher on conduct problems at 3 years of age also performed more poorly on expressive language assessments at this age. Two statistically significant

cross-lagged associations were also identified, although the magnitude of these associations were small. That is, poorer expressive language at 3 years was associated with increased conduct problems at 5 years and higher conduct problems at 3 years was associated with poorer expressive language at 5 years.

Cross-Lagged Model with Controls Added

Following the results obtained with the first model, we then tested a second model controlling for variables that have been previously implicated in studies of both conduct problems and language development. All controls were regressed on both conduct problems and expressive language at 3 years only to avoid saturation of the model. Results of this model are presented in Fig. 2. Auto-regressive standardised paths for both conduct problems and expressive language remained statistically significant. The initial concurrent path between conduct problems and expressive language at 3 years of age was no longer statistically significant, however a concurrent negative association was found at age 5. The initial cross-lagged paths from expressive language at age 3 to increased conduct problems at age 5 and the cross-lagged path from conduct problems at age 3 to poorer expressive language at age 5 both remained statistically significant.

When sex was regressed on conduct problems and expressive language at age 3, no statistically significant differences were found between boys and girls for either. Children's non-verbal cognition at 3 years was negatively associated with conduct problems and positively associated with expressive language. Hyperactivity/inattention at 3 years was found to be positively associated with conduct problems, but not with expressive language. With respect to parenting behaviours, no statistically significant associations were found with expressive language. However, harsh parenting was positively associated with conduct problems and positive parenting was negatively associated with conduct problems. In addition, maternal depression at 9 months was positively associated with conduct problems.

Table 2 Bivariate correlations, means, and standard deviations for conduct problems and expressive language

	Conduct problems 3 years	Conduct problems 5 years	Expressive language 3 years	Expressive language 5 years
Conduct problems 3 years				
Conduct problems 5 years	0.49			
Expressive language 3 years	-0.17	-0.16		
Expressive language 5 years	-0.15	-0.15	0.56	
Mean	2.53	1.52	49.46	54.62
Standard deviation	2.06	1.51	11.35	10.82

All correlations significant at $p < 0.001$

Table 3 Bivariate correlations among parenting behaviours and within child factors

	Harsh parenting	Positive parenting	Maternal depression	Cognition	Sex
Harsh parenting		NS	0.27***	0.02*	-0.09***
Positive parenting	NS		-0.06***	0.17***	NS
Maternal depression	0.27***	-0.06***		-0.07	-0.02**
Cognition	0.02*	0.17***	-0.07***		0.13***
Sex	0.09***	NS	-0.02**	0.13***	

*Significant *p* value at <0.05 level, **Significant *p* value at <0.01 level, ***Significant *p* value at <0.001 level

Discussion

The current study aimed to provide a clearer understanding of the directional associations between conduct problems and expressive language during a period when language is rapidly developing and conduct problems are beginning to emerge (e.g., Caultfield et al. 1989). Overall, the results with a large population-based sample support only modest reciprocal associations between conduct problems and expressive language that are already present between 3 and 5 years of age.

Results from the first model revealed statistically significant auto-regressive, concurrent, and cross-lagged associations, supporting both the stability and reciprocity of conduct problems and expressive language over this 2-year period. The sizable estimates of effect in relation to the auto-regressive paths are important as they suggest that the individual differences for each construct change only moderately over time. From a developmental perspective, the relative stability of language and conduct over time with moderate changes might be expected based on previous work examining trajectories in both domains (e.g., Lee 2011; Shaw et al. 2005). However, long-term maladaptation is not necessarily evident given that certain conduct related behaviours in the first 5 years are normative and that the first 4 years are characteristic of large variation in communicative language learning (Alink et al. 2006; Hoff 2005). That these paths show

congruency though would suggest that children who experience early problems in either domain may continue experiencing problems if remediation efforts are not available. Thus, in the context of these findings it could be recommended that parents pay particular attention to toddlers who display high levels of conduct related behaviours or who are late to reach particular developmentally appropriate milestones with respect to expressive vocabulary production. Both of which may be indicators of continued problems into the schooling years and necessary of potential remediation efforts.

The statistically significant cross-lagged associations in both directions, albeit modest, support previous studies with older children suggesting that children who struggle with early language acquisition are more likely to engage in higher levels of later conduct problems (e.g., Aro et al. 2012; Brownlie et al. 2004) and studies suggesting that children with elevated levels of conduct related problems are at increased risk of poorer subsequent language acquisition (e.g., Giddan et al. 1996). While unidirectional associations have more commonly been reported, this is likely due to the choice of statistical tests used (e.g., hierarchical regression) and sample characteristics (e.g., predominantly boys, older, and sub-clinical or clinical levels of either conduct or language impairment). Because parameters were not set a priori to impose restrictions on possible directions of association in our models, the results favour reciprocal paths between conduct problems and expressive language ability in a sample with characteristics generally representative of the overall population within the UK born during the new Millennium. The magnitude of both standardised cross-lagged estimates however remains small.

The minority of previous studies that have used large population cohorts have also found modest effects (Dionne et al. 2003; Girard et al. 2014; Oliver et al. 2004). Thus, our results are in line with the previous literature. It is possible that during the early stages of vocabulary development, a slower rate of acquisition may not have as detrimental effects on the emergence of conduct problems prior to school entry as opportunities for social interactions with peers, while starting to increase, may still be limited. Frustration that arises from a reduced ability to express needs and communicate may then be subsequently less prevalent during this time, resulting in the modest effects observed in the current study. Alternatively,

Cross-Lagged Model: Conduct Problems and Expressive Language (3 to 5 years)

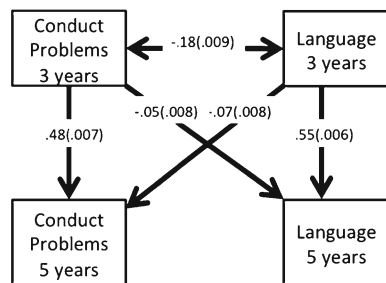


Fig. 1 Cross-lagged model examining the direction of associations between conduct problems and expressive language ability. Full information maximum likelihood used. All associations significant at *p* = < 0.001. Standard errors presented within brackets

Crossed-Lagged Model with Controls: Conduct Problems and Expressive Language
(3 to 5 years)

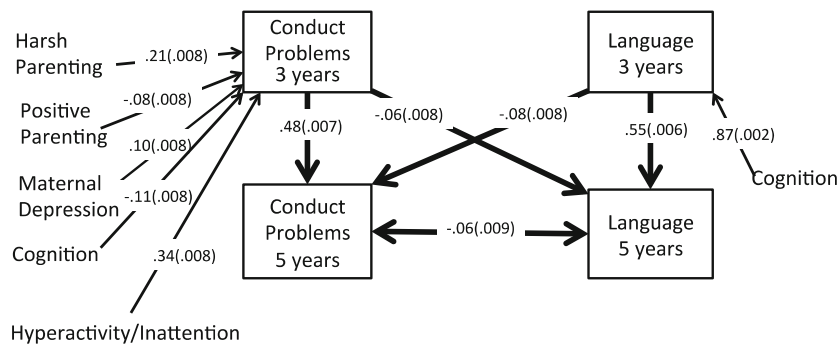


Fig. 2 A cross-lagged model of the directional associations between conduct problems and expressive language controlling for covariates. Full information maximum likelihood used. All associations significant at the $p < 0.001$ level. Only statistically significant associations are presented although all covariates were regressed on both conduct

problems and expressive language at 3 years. Standard errors presented within brackets. Maternal depression was collected when infants were 9 months. All other control variables were assessed when children were 3 years of age

given that particular conduct behaviours such as tantrums are relatively normative and decrease from toddlerhood to age 5, the impact on language learning across this particular 2-year period may only have a minimal impact. Despite the modest magnitude of associations, the mutually influential negative impacts of conduct problems towards expressive language and vice versa would suggest that if remediation efforts are in fact needed, they should target skill development holistically, across both social and cognitive domains in early childhood.

It is also possible that within a general pediatric population, associations may be more reflective of a parallel rather than predictive process partially explaining the modest effects (Girard et al. 2014). For example, the cross-lagged model including covariates revealed direct effects of maternal depression, harsh parenting, positive parenting, children's nonverbal cognition, and hyperactivity/inattention on conduct problems. Additionally, direct effects of nonverbal cognition on expressive language were found. The initial concurrent association between conduct problems and expressive language at 3 years was no longer statistically significant when covariates were included, suggesting that parenting behaviours or within-child factors are more influential for the emergence of conduct problems in particular in the first 3 years of development. Based on the two-wave design of our study, we are not able to further examine the possibility of a mediation model. For instance, it is possible that harsh parenting may influence increased conduct behaviours through modeling or alternatively, parents with children who engage in elevated conduct behaviours may resort to the use of more harsh discipline. Future work should strengthen the current study by testing for mediation effects rather than just controlling for the direct effects of covariates.

While our results suggest that other factors may play a larger role in the initial emergence of conduct problems in

particular and to a lesser extent towards poorer expressive language in the first 3 years, the emergence of problems in one domain can in fact negatively impact upon the other across time. Inferences surrounding causal paths should however be cautioned. As previously highlighted, there is a scarcity of studies that have examined these associations prior to entry into formal schooling using population-based samples. The majority of studies conducted with older clinical samples have found more support for an association in the direction of language difficulties to subsequent behaviour problems (Beitchman et al. 2001; Botting and Conti-Ramsden 2000; Brownlie et al. 2004; Camp et al. 1997). Thus, the results of the current study add to the literature by suggesting that in the early years, the direction of association may present differently in population samples (i.e., reciprocal and possibly parallel rather than unidirectional). The results also revealed a modest significant concurrent association between conduct problems and expressive language ability at 5 years suggesting that this association may stabilise once formed if no remediation efforts are implemented. However, replication is needed with studies examining the associations from toddlerhood into later childhood to better understand the stability of these associations and whether directionality changes over time or whether increases in effect sizes might be observed.

Limitations of the Present Study

Although this study used one of the largest available datasets during early childhood, it is important to acknowledge its limitations. First, there were no behaviour or language measures collected prior to age 3. Given the findings at 3 years of age, it may in fact be possible that these associations were present earlier in the lifecycle. Investigating the associations in the second year of life when conduct problems start to emerge and when children's language is rapidly developing

could be a direction for future studies. This would provide additional insight on the issue of directionality from an earlier age.

Second, our model could not be extended beyond 5 years of age as wave 4 of the MCS (7 years of age) utilized the word reading scale of the BAS rather than the naming vocabulary scale that was used in waves 2 and 3. Unfortunately, no measure of expressive vocabulary was collected during wave 4. From a developmental perspective, future studies should examine the associations more longitudinally (e.g., from toddlerhood to adolescence) to uncover whether changes in the magnitude or the direction of associations are observed. Further, this would create a more comprehensive understanding of studies that focus on the very early years and find modest associations, as compared to studies utilizing older samples of children that find stronger effects.

Third, in the current study we focus on children's expressive language only. While expressive language has been implicated in previous studies of conduct problems and language development, this does not preclude the possibility that other areas of children's language such as receptive and pragmatic language may also play contributing roles. Future work should assess multiple areas of language to examine which types of language are most strongly implicated in the early years of development.

Fourth, the internal consistency of the expressive language scale at age 5 borderlines on acceptable (i.e., Cronbach's alpha of 0.59); similar to that reported in the manual for this age group. One of the greatest challenges in using a measure with a low internal consistency is that any association found is attenuated by the reduction of the maximum observable correlations between variables (Schmitt 1996). Thus, the path from increased conduct problems at 3 years of age to poorer expressive language at 5 years of age in the current study may in fact be underestimated. Some caution is warranted in interpreting this path of association before replication using alternative measures is conducted.

Fifth, we are limited in our ability to draw firm conclusions with respect to the direction of associations regarding parenting styles that were implicated in the model. The ways in which parents interact with their children is a dynamic process influenced by both internal characteristics of the parent and by the temperament and behaviour of the child. While our results reveal that maternal depression, positive, and harsh parenting exert influences on conduct problems, the exact mechanism driving this association cannot be inferred given the study design. Ideally, it would be advantageous to collect measures of parent interactions at multiple assessment points throughout children's development and more specifically prior to the first assessment of conduct problems and language ability.

Finally, due to model saturation, we were unable to regress covariates on age 5 conduct problems and expressive language. While the assumption of stationarity could be made

with respect to the covariates used, further longitudinal studies are needed that include more assessment points over time which would allow for the ability of additional paths to be examined. This would provide a clearer understanding of whether or not parenting or within-child factors continue to, or differentially effect the observed associations over time.

Overall Conclusion

Overall the results of the current study with a large population birth cohort suggest that between 3 and 5 years of age, both early conduct problems and expressive language difficulties can impact negatively on the emergence of the other over time, albeit modestly. The results also indicate that the associations found between conduct problems and expressive language abilities are impacted upon through direct effects of external factors such as parenting behaviours, children's non-verbal cognition and hyperactivity/inattention; particularly with the case of conduct problems and to a lesser extent expressive language. Further studies utilizing large population-based samples are needed that collect assessments of children's behaviour and language abilities at least by 12 months of age and after 5 years of age through to adolescence to provide a more comprehensive developmental understanding of the associations. Additionally, these studies should collect measures of parenting behaviours in the first year of life to provide more insight regarding the possible mediating role of parenting behaviours. Finally, the need for experimental studies that are better able to assess causal associations between conduct problems, language development, and parenting are warranted.

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Compliance with Ethical Standards

Conflict of Interest There are no conflicts of interest for any author listed in the byline of this manuscript. Further, the authors report no financial relationships with commercial interests.

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