(Mis)perceptions about children [*]

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Abstract

Policymakers, schools, and parents often rely on teachers' perceptions about child development to inform their decisions about investments in children. In this paper, I show that early childhood education instructors' perceptions about developmental delays are not only influenced by children's own development but also by the average level of development of other children in the neighbourhood. I quantify the influence of the reference group on instructors' perceptions of developmental delays using both non-cognitive (socio-emotional) and cognitive (receptive language) objective development measures from the Longitudinal Study of Australian Children, assessed by psychologist-trained interviewers. I show that instructors in neighbourhoods with lower average levels of non-cognitive development are less likely to perceive delays in both non-cognitive and cognitive dimensions of child development, conditional on objective development measures. This implies that they are less likely to recognize a developmental delay if such delays are more prevalent in the neighbourhood. Further, the maternal perceptions of their children's non-cognitive development are influenced by the information about delays that teachers convey. Teachers' and mothers' beliefs about delays predict investment in remedial services including children's learning and behavioural therapy, and tutoring, as well as parental attitudes toward their children. Finally, I show that instructors with college degrees in education are more likely to identify children with low levels of development compared to instructors with diplomas or certificates.

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1 Introduction

Correctly identifying the developmental trajectories of children is critical for schools and families when they make decisions to invest in child development, from parenting time and reading with children to hiring professional help like tutors and psychologists. Because of this, biased perceptions of child development lead to suboptimal investment strategies and disrupt the accumulation of human capital (Kinsler and Pavan, 2021, Dizon-Ross, 2019, Bergman, 2021). Two main decision-makers in children's lives, their families and their schools, commonly rely on teachers' professional judgements in the search for information about children's progress.[3]

The teacher's role is particularly important in identifying the non-cognitive (socio-emotional) developmental delays in children. Developmental delay occurs when a child does not reach their developmental milestones within the expected time frame, relative to the population of children of the same age. An example of non-cognitive delay in preschool-aged children can be a behavioural disorder, which typically manifests in severe temper tantrums.[4] While standardized objective tests usually complement teachers' perceptions of children's cognitive delays, teachers' judgement about non-cognitive delays often remains the main source of information for school administrations, governments, and even families, due to the lack of objective measures of non-cognitive development available for a population of children. Early developmental delays are particularly costly for children since skills are self-productive, and being developmentally on track before the start of formal schooling allows children to successfully learn and socialize in later childhood and youth (Cunha, Heckman, and Schennach, 2010). Up to 50% of preschool behavioural problems can persist and develop into childhood mental health problems, leading to an increased risk of substance misuse, family violence and later, crime (Luangrath and Hiscock, 2011).

I show that in the early childhood education setting, perceptions of teachers (early childhood instructors) about developmental delays in children ages 4-5 depend systematically on the

[3]For example, in 2024 in Australia, over 12 percent of total government school funding was allocated to fund accommodations for students with disabilities mainly based on the judgement of teachers and other classroom professionals. Accommodations were offered to almost a quarter of students and over 88% of these accommodations were offered to address cognitive and non-cognitive delays in children. See Australian Curriculum Assessment and Reporting Authority report and Australian schooling resources standard.

[4]Examples of cognitive delays are speech and language delays.

average level of non-cognitive development of other children in the neighbourhood.[5] Teachers of children who live in neighbourhoods with lower average levels of non-cognitive development are less likely to perceive delays in both non-cognitive and cognitive dimensions of development. This implies that teachers are less likely to recognize a developmental delay if delays are more prevalent in the neighbourhood. I show that these misperceptions have a cascading effect on how mothers perceive their children and home and school environments. Teachers' perceptions influence mothers' perceptions of their children. In turn, these perceptions relate to the uptake of therapy services by children and their home environment, including tutoring, parenting styles, and aspirations.

Understanding that teachers and parents can have biases, many governments aim to complement subjective perceptions about child development by conducting nationwide standardized tests of cognitive skills.[6][7] Using objective measures of children's cognitive development available for a representative sample of young children in the U.S., two recent papers have provided the first evidence that teachers' perceptions about cognitive development in children suffer from reference group bias (Kinsler and Pavan, 2021, Elder and Zhou, 2021). Reference bias occurs when teachers in schools with lower average academic achievement tend to overestimate cognitive skills in children. This potentially leads to suboptimal investment choices and underestimation of skill inequality in children.

Non-cognitive skills were shown to be as important as cognitive skills for a variety of life outcomes, including earnings (Deming, 2017), schooling and risky behaviours (Heckman, Stixrud, and Urzua, 2006), and health (Conti, Heckman, and Pinto, 2015). However, in contrast to cognitive skills, non-cognitive skills are notoriously hard to measure. There is often no objective measure of non-cognitive development available for a population of children. Due to the lack of objective measures, the influence of the reference group on perceptions of non-cognitive skills has not yet

[5] While I refer to all early childhood instructors as teachers, in the Australian setup early childhood instructors can be early childhood teachers or early childhood educators depending on their level of education.

[6] For example, the National Assessment Program – Literacy and Numeracy (NAPLAN) is conducted in Australia, Education Quality and Accountability Office (EQUAO) provincial assessments are conducted in Canada, National Assessment of Educational Progress is conducted in the U.S.

[7] While suffering from important limitations like the strong association with students' effort during testing (Zamarro, Hitt, and Mendez, 2019) or the reinforcement of unequal opportunities (Reeves and Halikias, 2017), test scores provide an objective measure of children's positions in the distribution of cognitive skills for similar-aged children.

been directly quantified from the data.[8]

I overcome this challenge by using direct observations from psychologist-trained interviewers who evaluate children's non-cognitive skills during face-to-face interviews for the Longitudinal Study of Australian Children (LSAC), a nationally representative survey of 10,000 children followed biennially starting in 2004. These observations provide objective measures of children's non-cognitive skills in addition to measures of cognitive skills based on language tests that are also available in the dataset.[9] To quantify the role of the reference group in teachers' perceptions of non-cognitive and cognitive delays, I use an approach similar to Kinsler and Pavan (2021) and Elder and Zhou (2021) and estimate a measurement system of teachers' perceptions about delays allowing them to depend on both children's individual development and on the average level of child development in the neighbourhood.

I use teachers' private beliefs about delays in children's cognitive and non-cognitive development relative to other children of a similar age as measures of teachers' perceptions. I show that teachers in neighbourhoods where kids have lower average objective measures of non-cognitive development are less likely to perceive non-cognitive and cognitive delays conditional on objective measures of skills. Specifically, teachers in neighbourhoods at the top quartile of average non-cognitive development are 1.4 percentage points more likely to report non-cognitive delays compared to teachers in bottom-quartile neighbourhoods. By contrast, they would be up to 10 percentage points less likely to report non-cognitive delay if their perceptions were not impacted by the reference group.

My results also indicate that teachers' perceptions of cognitive delays in children depend on the average level of cognitive development for other children in the neighbourhood, expanding on the findings in Kinsler and Pavan (2021) and Elder and Zhou (2021) obtained for the U.S. setting with higher inequality. These findings have important implications for governments aiming to identify disadvantaged areas based on nationwide teacher evaluation statistics like the Australian

[8] Elder and Zhou (2021) quantify the potential impact of reference group bias on estimated racial gaps in non-cognitive skills, however, in the absence of objective measures they rely on restrictive assumptions about the unobserved distribution of non-cognitive skills or the magnitude of the reference bias. By contrast, I take a data-driven approach to quantifying the influence of the reference group on beliefs about non-cognitive delays.

[9] While these measures cannot be used to diagnose children with delays, they provide a standardized continuous measure of development for a nationally representative sample of children.

Early Development Census, as the prevalence of child developmental delays is underestimated in disadvantaged areas and overestimated in advantaged ones. Similarly, researchers relying on subjective perceptions about child development reported by teachers and parents should account for the potential reference bias in their interpretations of estimated gaps in skills across children and changes in skills with age.

I contribute to studies analyzing the impact of educational program characteristics on student outcomes by exploring the role of early childhood instructors' qualifications and classroom characteristics in beliefs about developmental delays.[10] In Australia, early childhood education professionals can become teachers if they obtain a college degree in early childhood education. Alternatively, they can work as early childhood educators if they do not have a college degree in education, but have obtained relevant diplomas or certificates, which typically take one to two years to complete. I find that early childhood teachers who hold college degrees in education have a higher probability of indicating developmental delays in children with low objective measures of development. For the subsample of children with low objective measures of non-cognitive development, teachers with a university degree in education are 9 percentage points more likely to perceive delays in non-cognitive development compared to educators with certificates or diplomas. Similarly, for children with low objective measures of cognitive skills, teachers with university training are 6.7 percentage points more likely to report delays. This advantage in delay recognition is driven by the stronger association between children's objective development measures and delay recognition in teachers with university training in education. This implies that training can be an effective tool in supporting teachers' delay recognition.

I show that mothers update their perceptions when teachers inform them about non-cognitive delays in children. While the role of schools in mothers' perceptions about children's academic progress has been studied in the literature (Dizon-Ross, 2019, Doss, Fahle, Loeb, and York, 2019), the relationship between teachers' and mothers' perceptions about non-cognitive skills is less understood. I use information contained in the LSAC about mothers being contacted by schools about children's behavioural problems to quantify the effect of teachers' delay identification on

[10] For example, Chetty, Friedman, Hilger, Saez, Schanzenbach, and Yagan (2011) document that students who had a more experienced teacher in kindergarten have higher earnings. Goldhaber and Brewer (2000) show that teachers' certification has a significant effect on students' test scores.

mothers. For mothers of children ages 8-9 being contacted by the school increases the probability that they perceive their child to have non-cognitive delays by 11 percentage points.

I provide evidence that the perceptions about developmental delays are important predictors for the uptake of community and school services like therapy directed at non-cognitive or cognitive skills. In my data, teachers and mothers report whether children use school or community services like behavioural therapy or psychological evaluation, as well as speech and learning therapy. Children whose teachers perceive non-cognitive delays are 4 percentage points more likely to use behavioural therapy or undergo a psychological evaluation by the time they are 6-7 years old. They are also 6 percentage points more likely to use learning or speech therapy if their teachers perceive cognitive delays when they are ages 4-5. These results imply that misperceptions about children can be an important course of misallocation of resources across neighbourhoods.

Moreover, I provide suggestive evidence that perceived non-cognitive delays by mothers relate to the quality of parent-child interactions, parental attitudes and family investment decisions that were shown to be productive for non-cognitive development (Fiorini and Keane, 2014, Falk, Kosse, Pinger, Schildberg-Hörisch, and Deckers, 2021). I estimate value-added regressions of family investment choices on mothers' perceptions about non-cognitive delays accounting for the potential endogeneity of perceptions and persistence in investment. I show that perceptions of non-cognitive delays by mothers have two opposing effects on parenting choices. Mothers reporting non-cognitive delays in children engage in lower-quality parent-child interactions and hold lower educational aspirations for their children. By contrast, delay recognition by mothers is associated with higher use of tutoring and higher uptake of parenting education resources.

On one hand, recognizing delays in children induces parents and teachers to reach out for professional help for their children. Because of this, reference bias in perceptions can perpetuate inequality in skills between advantaged and disadvantaged areas through differential investments in children. On the other hand, delay recognition is associated with a lower quality of parent-child interactions, therefore, overestimation of delays may also lead to negative consequences for children who are developmentally on track. In this way, my work sheds light on sources of differences in child environment across parental socioeconomic status (SES) and the role of neighbourhoods. I emphasize the role of neighbourhood-related information frictions in explaining differences in parental behaviour in addition to other factors including resource constraints, preferences, and differences in perceptions about returns to investment that have been shown to drive the gaps in parental investment across the SES and neighbourhoods.[11]

My paper adds to the broader literature on the relationship between parental perceptions and parenting choices. An important strand of this literature has explored the relationship between differences in beliefs about returns to various types of parental investments and actual investment choices.[12] Instead, I focus on the assessment of child development and its role in family investments and parental attitudes. I contribute to research investigating the relationship between parental perceptions of children's skills and their decisions regarding children's environment by exploring perceptions and parenting choices related to non-cognitive skills.[13]

This paper proceeds by first documenting the source of distortions in perceptions about child development and then exploring its consequences. Section 2 describes the data that allows me to investigate the role of the reference group in teachers' perceptions and its effects. Section 3 presents a conceptual framework where reference group bias in teachers' perceptions can result in a cascading effect on home and school environments. Sections 4 and 5 describe the analysis and conclusions for the role of the local environment in teachers' and mothers' perceptions of child development. Sections 6 and 7 proceed by exploring the impact of these perceptions on family investment choices. Section 8 provides some final discussion.

2 Data

The data for this project come from the LSAC, a national study of children in Australia that tracks childhood environments, development, and life course trajectories. The survey commenced in

[11]See Attanasio, Cattan, and Meghir (2022) for the review of research exploring the drivers of SES gaps in children's environments.

[12]For example, Boneva and Rauh (2018) document parental misperceptions about the timing of returns to early versus late childhood investment. Kiessling (2021) explore the relationship between perceived returns to parenting style and neighbourhoods and actual parental choices. Attanasio, Cunha, and Jervis (2019) show that mothers underestimate the returns to their investments in children and beliefs about returns predict actual investment choices.

[13]For example, using an experimental setting Dizon-Ross (2019), Doss, Fahle, Loeb, and York (2019), and Bergman (2021) show that mothers who update their beliefs about their children's academic progress also update choices of educational inputs. Bergman (2021) also shows that correcting mothers' misperceptions about children's learning efforts lead to improved students' learning efforts according to teachers' evaluations.

2004 with participating families interviewed once every two years. It follows the development of two cohorts of children: the baby cohort (B-cohort), which includes 5107 children aged 0-1 in 2003-2004, and the kindergarten cohort (K-cohort) which follows 4983 children aged 4-5 in 2004. In this paper, I use the data for children between 4 and 11 years old, however, the most recent waves of the survey follow the kindergarten cohort till the age of 18-19 and the baby cohort till the age of 14-15.

The survey has four features that allow me to investigate the local environment's impact on teachers' perceptions. First, it contains a rich set of objective child development measures obtained during the interview that can be matched to perceptions reported by teachers and parents. Second, the sample is clustered at the neighbourhood level, which allows me to construct a measure of the local environment by matching children from the same neighbourhood. Third, it tracks the dynamics of multiple measures related to children's home and school environments. Finally, the survey collects a comprehensive set of information about family demographic and educational composition, family income, labour market outcomes, and neighbourhood characteristics.

2.1 Measures of child development

The survey collects information about child development from three sources: interviewers observing children during face-to-face interviews, teachers, and parents. First, trained interviewers use tests and direct observations to assess children's cognitive and non-cognitive development. Second, teachers evaluate child development and the classroom environment. Finally, children's primary caregivers, mainly mothers, are asked to evaluate child development and environment during face-to-face interviews.

I use direct observations of children's non-cognitive skills recorded by interviewers during the in-person household visit to construct an objective measure of non-cognitive development. These observations are available when children are 4-5 and 8-9 years old. The face-to-face part of the interview lasts 1 - 2.5 hours with and without the parent present, giving interviewers a chance to observe children during a variety of interactions. The interviewers evaluate the non-cognitive development of children across three dimensions: negative response, focus during the cognitive test, and positive response. The negative response includes fussing, pouting, whining, crying, and vocal/physical expressions of anger. Persistent loss of temper and aggressive behaviour are the symptoms of disruptive behaviour disorders in children.[14] The second dimension is the degree to which the child was able to sustain an interest in cognitive tasks. According to the Australian Psychological Society, difficulty concentrating and staying focused is the main symptom of ADHD in young children [15] The third dimension is the degree of positive response by children, which includes smiling, laughing, or sounding excited, happy, or pleased.

These measures have three important advantages useful for quantifying the role of the reference group for teachers' perceptions. First, interviewers were trained by psychologists to conduct the evaluations consistently and went through practice interviews with parents and children. Second, interviewers relied on an objective scale to count the number of times and intensity of behaviours. For example, the interviewers choose from 5 options while evaluating the children's negative or positive response: none displayed, 1-2 brief displays, 3 or more brief displays, 1-2 intense, heightened or prolonged displays, 3 or more intense, heightened or prolonged displays.[16] The method of direct observation using objective scales was developed by psychologists to complement the diagnosis of behavioural problems in children (Volpe, DiPerna, Hintze, and Shapiro, 2005, Minder, Zuberer, Brandeis, and Drechsler, 2018). The use of objective scales and extensive training were aimed at minimizing the potential bias in interviewers' assessments. Finally, the interviewer's evaluations are available for a nationally representative sample of children. Observations of children's non-cognitive development did not add to the time or cost of the interview since the children were not asked to go through any additional testing. Therefore, the design of the interviewers' evaluation of non-cognitive development in LSAC allowed for large-scale direct evaluations.[17]

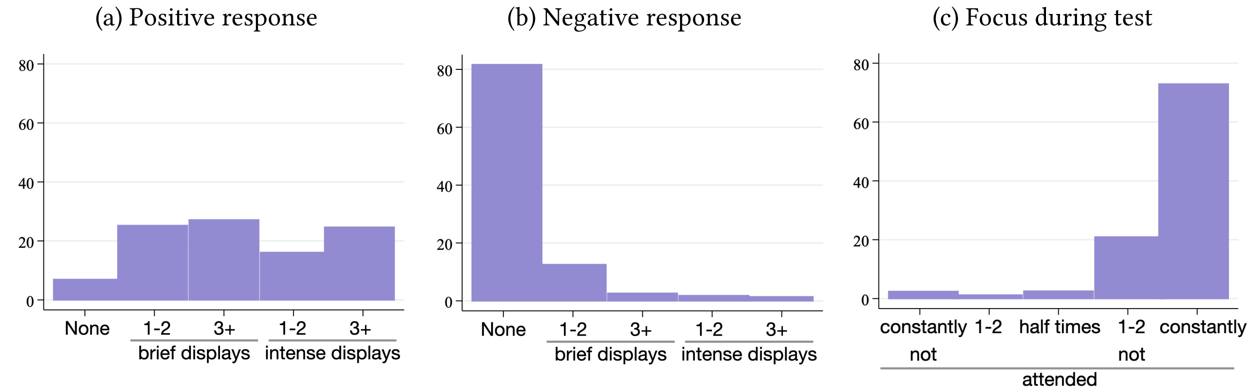
[14]See Centers for Disease Control and Prevention.

[15]While in the psychology literature, the focus is considered to be a cognitive process, inattention is a common symptom of behavioural and neuro-behavioural problems in children. See Australian Psychological Society definition. Moreover, in the education literature, the ability to pay attention and concentrate is commonly used as a measure of student effort or behaviour, which refers to students' non-cognitive skills (Rosen et al., 2010, Lundberg, 2017). Therefore, I include a measure of inattention in my baseline measure of non-cognitive skills and explore the sensitivity of my results to this choice in Appendix C.

[16]The 5 options for the degree of children's focus include: Constantly did not pay attention; Typically did not pay attention, attended in 1-2 instances; Did not pay attention half the time; Typically paid attention, but attention wandered in 1-2 instances; Constantly paid attention/concentrated.

[17]By contrast, evaluations of non-cognitive skills by psychologists who directly observe children are less common in large-scale survey datasets, as these types of evaluations are often more resource-intensive and time-consuming.

Figure 1: Non-cognitive development observed during the interview at ages 4-5



Notes: The figure displays histograms of the interviewer's records evaluating the non-cognitive skills of children ages 4-5 during the interview. Panel a) records the degree of positive response from the child, where the positive response includes smiling, laughing, or sounding excited, happy or pleased. Panel b) records the degree of negative response from the child, where the negative response includes fussing, pouting, whining, crying and vocal or physical expression of anger. Panel c) records the degree of the child's focus during the PPVT cognitive test.

I construct children's objective non-cognitive development score as the first principal component of the three age-standardized objective measures of non-cognitive skills. I age-standardize the interview non-cognitive score to make it comparable in scale to other skill measures used in the analysis. Figure 1 illustrates the distribution of the interviewers' observations when children were 4-5 years old. While children's degree of positive response varied a lot between children, 62 percent of children were both constantly focused during the interview and did not show any negative responses. Figure A.1 shows that the distribution of the interview non-cognitive score is skewed to the right, with many children receiving maximum or near-maximum scores and a long left tail with children demonstrating non-cognitive problems with varying degrees of frequency and intensity. The interview measure of non-cognitive skills allows me to detect children with symptoms of behavioural delays in the left tail of non-cognitive skill distribution, however, it does not differentiate between children on top of the skill distribution who are more likely to be developmentally on track.

The receptive language dimension of cognitive skills is measured during the interview by the short form of the Peabody Picture Vocabulary Test (PPVT). It is a standard age-adapted measure of children's receptive vocabulary and knowledge of spoken words. This test is commonly used in the literature as a measure of children's cognitive skills (Fiorini and Keane, 2014, Nicoletti and Tonei, 2020). Another measure of cognitive skills that is available in the survey is the Who Am I assessment (WAI) which is used for children aged 4–5 to measure the general cognitive abilities needed for starting the school. This measure tests receptive and expressive language and numeric abilities. I use it as an instrument to address measurement error in the PPVT measure.

A common critique of standardized tests of cognition is that they provide context-dependent measures of children's academic abilities. They depend on students' effort, motivation, test-taking abilities, and a range of other factors (Heckman and Kautz, 2012). The measure of children's non-cognitive skills obtained from a limited set of interactions between interviewers and children is likely to have similar limitations. By contrast, teachers' perceptions are enriched by teachers interacting with children in multiple environments and learning about children's history, family, and community. While it is unlikely that the interview scores capture all the relevant information about child development, they provide measures of non-cognitive development and cognition that are objective and reflect variation in children's skills that predicts future outcomes.[18]

2.2 Measures of perceptions about child development

An important advantage of the LSAC survey is that it measures teachers' private perceptions about children's developmental delays. When children are 4-5 years old, teachers' private beliefs about the development of the child relative to children of the same age are elicited through the teachers' questionnaire.[19] Teachers are asked to evaluate the child's development level compared to other children of a similar age in several dimensions, including social/emotional development (e.g. adaptability, cooperation, responsibility, self-control) and receptive language ability (e.g. understanding, interpreting, and listening).[20] These perceptions align with the dimensions of child development assessed by interviewers, enabling a direct comparison between measured

[18]For example, children's cognitive and non-cognitive scores at ages 4-5 are associated with a lower likelihood of children repeating a grade by ages 12-13 and higher Grade 9 national test scores in reading and numeracy (see Appendix B).

[19]Teachers were asked to fill in the self-complete questionnaire and mail it in a pre-paid envelope. Therefore, parents did not know about the details of teachers' replies, and teachers had comparable incentives to report their beliefs.

[20]The exact question is "Rate how this child was compared with other children of a similar age, over the past few months."

development and teachers' perceptions. The results of assessments performed during the interviews are unknown to teachers and parents. Teachers can rank the child as much more competent than others, as competent as other children, less competent than others, and much less competent than others. I construct a binary variable for teachers perceiving developmental delays in the non-cognitive dimension if they report that children are less or much less competent than other children in non-cognitive development.[21] Similarly, teachers report delays in the cognitive dimension of development if they indicate that children are less or much less competent than other children in receptive language development. Only 15 percent of teachers indicate delays in children's cognitive development and over 20 percent of teachers indicate delays in children's non-cognitive development (see Appendix Table A.1).

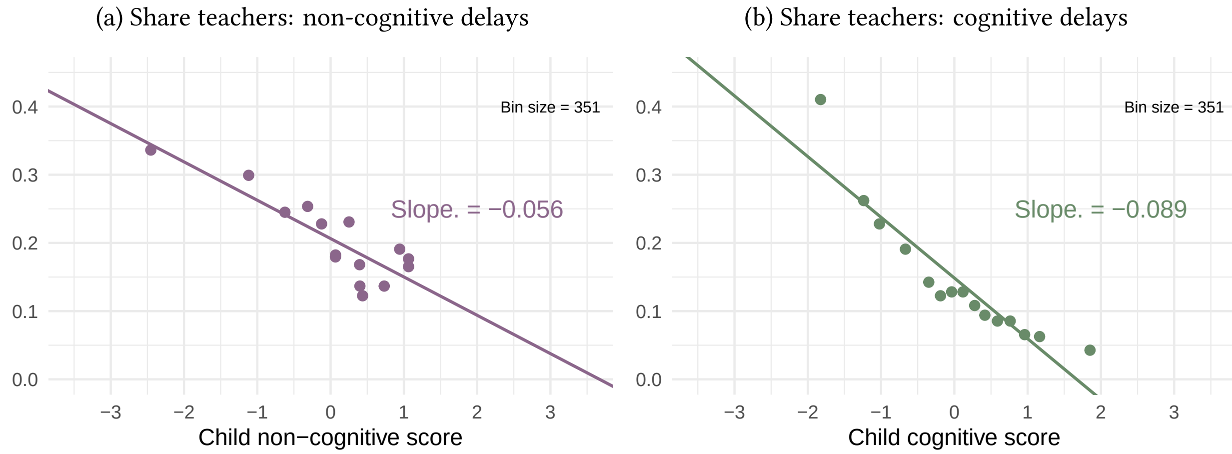
Figure 2 summarizes the relationship between teachers' perceptions and children's development scores measured during the interview. Panel (a) plots the average share of teachers reporting non-cognitive delays against children's non-cognitive interview scores. The negative slope implies that both teachers' perceptions and interview measures are informed by children's non-cognitive development. Specifically, children who received higher non-cognitive development scores during the interview are less likely to be perceived as having non-cognitive delays by their teachers.[22] Similarly, Panel (b) shows that teachers are less likely to report cognitive delays for children who received higher cognitive interview scores. While the estimated relationship between the measured development and the probability that teachers indicate delays is negative, my analysis will show that this relationship is distorted by the influence of the reference group on teachers' judgement.

The survey also collects mothers' perceptions about delays in their children's non-cognitive development. Mothers are asked to evaluate whether the child is more difficult compared to other children of similar age. Mothers can respond that the child is easier than average, about average, or more difficult than average. I create a binary measure for mothers perceiving non-cognitive delays in their children equal to one if they perceive their child as more difficult compared to

[21] Less than 4% of teachers indicate that children are much less competent than other children in non-cognitive or cognitive dimensions, therefore, I pool the "much less competent" and "less competent" replies together to indicate delays.

[22] Panel (a) also reflects that the distribution of interview non-cognitive scores is skewed to the right with children clustered at the right tail of the skill distribution.

Figure 2: Children's interview development scores and teachers' perceptions at ages 4-5.



Notes: Panel (a) displays binned scatterplots of the share of children whose teachers perceive non-cognitive delays conditional on their non-cognitive interview development score. Panel (b) displays binned scatterplots of the share of children whose teachers perceive cognitive delays conditional on their cognitive interview development score. Both panels report raw regression lines. The sample includes children ages 4-5 with non-missing interview cognitive and non-cognitive development scores, neighbourhood average development scores, and measures of teachers' perceptions.

other children of similar age. Only 7 percent of mothers consider their child to have a delay in non-cognitive development (see Appendix Table A.1).

Importantly, measures of teachers' and mothers' perceptions recover their private beliefs about children's development relative to the whole population of similar-aged children. Delay identification by mothers and teachers, therefore, should involve a comparison of children's skills to age-specific developmental milestones, but not a comparison relative to their class or grade level within their school or neighbourhood. When asking teachers or mothers to compare children's development against other children in the group, class, or grade level, the questionnaire explicitly provides the reference group.[23] Moreover, Kinsler and Pavan (2021) show that when evaluating cognitive skills, mothers respond differently when asked to compare their child against other children of a similar age and other children in their child's class.

An important advantage of the LSAC for exploring the relationship between mothers' and teachers' perceptions is that when children are 8-9 years old, mothers are asked whether the

[23]For example, in the same questionnaire teachers' are asked: "During organized physical activities for your group, how does this child compare with other children in the group in terms of the level of physical activity?"

school has contacted them about their children's behaviour within the last 12 months. This indicator allows me to go beyond estimating the potentially bidirectional association between mothers' and teachers' perceptions about children, and evaluate how mothers update their beliefs when they are informed by schools about their children's non-cognitive delays.

2.3 Measures of school and home environments

I also explore the role of delay recognition for school and family investments, as well as parental attitudes. The survey collects a wide variety of information about the home environment, such as parental and school investment into remedial services like behavioural, speech, and learning therapy, parenting styles, and tutoring. These measures allow me to explore the role of teachers' and mothers' perceptions in choices of inputs that have been shown to matter for child development by previous research (Cunha, Heckman, and Schennach, 2010, Caucutt, Lochner, Mullins, and Park, 2020, Del Boca, Flinn, and Wiswall, 2014, Fiorini and Keane, 2014).

The school- or neighbourhood-based investment measures include two types of therapy, one directed at the treatment of cognitive skills (learning or speech therapy), and another directed at the treatment of non-cognitive skills (behavioural or psychological therapy). LSAC asks teachers and mothers whether children have used additional school or community services that can allow children with delays to catch up. I create a binary variable indicating that the child has used behavioural or psychological therapy if teachers report that the child used behaviour management programs or had a psychological assessment while being in their care or if mothers report that, in the last 12 months, they have used a guidance counsellor or other psychiatric or behavioural services for the child. I create a binary learning or speech therapy variable equal to one if teachers indicate that the child has used speech therapy or learning support while in their care and if mothers indicate that the child has used speech therapy in the last 12 months. At ages 4-5, around 4 and 14 percent of children are reported to have received non-cognitive and cognitive therapy, respectively (see Appendix Table A.4). At ages 6-7, the rates of non-cognitive therapy uptake increased to 6 percent, while the rates of cognitive therapy decreased to 12 percent.

Measures of family investments and parental attitudes include LSAC-constructed scores measuring warmth and anger of mothers' parenting style, parental uptake of community resources like parenting education courses and support groups, weekly additional help or tutoring sessions, expectations about children's future educational achievements, and other measures of quality time with household members including the total time, and weekly times household members spent reading with the child (see Appendix A.4).

2.4 Measures of the local environment

To measure the local environment I exploit information on the current household location. I use postcodes as the geographic unit defining neighbourhoods. Crucially, the sampling design of the LSAC survey allows the grouping children together based on their current postcode.[24] Australia has over 3000 postcodes. The sample in the first wave of the survey includes children from 409 postcodes representing all Australian territories with an average of 37 children per postcode. For example, in Sydney and Perth children from 93 and 35 postcodes, respectively, were selected to participate in the survey. The availability of multiple child observations per neighbourhood and the sampling design, which is representative of the population of Australian children, allows me to compute neighbourhood child development levels.

To analyze the effect of local environment on the identification of children's developmental delays, I calculate it using the average levels of non-cognitive and cognitive development of other children living in a child's neighbourhood. To quantify the role of the reference group for teachers' perceptions, I need objective measures of average child development in neighbourhoods. For each child, I compare children of a similar age in both cohorts living in the same postcode. I construct the leave-one-out average neighbourhood child development score in two steps. First, I de-mean interview development measures by year and age group. Second, I use de-meaned scores excluding children's own scores to construct the average neighbourhood score if measures for at least 10 children other than the study child were available in a given neighbourhood in total for both cohorts. The measure, therefore, allows the distribution of development levels to shift in a parallel fashion across time.[25] I then standardize the neighbourhood's average levels of

[24] A sample was selected to be representative of all Australian children in the selected age cohorts. It was drawn using the two-stage stratified sampling procedure, with the first stage including a selection of postcodes to ensure proportional geographic representation for Australian territories, and the second stage selection of children from these postcodes.

[25] See Appendix C for the discussion of modifications to the construction of the average neighbourhood develop-

development within age groups to make the scale comparable to individual assessments.

3 Conceptual framework: The role of bias in teachers' perceptions

This section describes a conceptual framework in which reference group bias in teachers' perceptions can lead to a cascading effect on the children's environment inspired by the setting in Kinsler and Pavan (2021). Consider a child of age t with a development level D_t. During the interview, this development level is evaluated by a psychologist-trained interviewer who assigns a continuous measure D^I_{it} so that

$$D^I_{it} = D_{it} + \mu^I_{it}, \text{ s.t. } \mu^I_{it} = \Theta^I_{it} + \epsilon^I_{it}, \tag{1}$$

where μ^I_{it} summarizes potentially unobserved factors that can affect the objective interview measures, ϵ^I_{it} is a mean-zero iid measurement error, and $\Theta^I_{i,t}$ is an idiosyncratic interview day shock which can be correlated across different interview development measures. For example, this shock captures potential differences in children's interview efforts across neighbourhoods. It can be important in the setting where the interview takes place at children's homes, and, therefore, conditions of the interview in terms of parental support and interruptions from siblings can be correlated with the neighbourhood's advantage.

Teachers aim to identify developmental delays in children, $T_{it} = \{0, 1\}$. To do so, they compare children's development against perceived age-specific developmental benchmarks. If these perceived standards of development are affected by the level of development of other children in the neighbourhood, teachers' delay recognition depends both on a child's own development level and on the average development level in the neighbourhood, $\bar{D}^N_{it}$. Thus, teachers' perceptions about children's delays relative to other children of the same age are

$$T_{it} = F^T(D_{it}, \bar{D}^N_{it}, X^T_{it}) + \mu^T_{it}, \text{ s.t. } \mu^T_{it} = \Theta^T_{it} + \epsilon^T_{i,t}, \tag{2}$$

ment.

where X_{it}^{T} are variables related to children's development and perceptions that are observed by both interviewers and teachers. These variables can affect perceptions conditional on children's true development levels. For example, teachers may perceive children from lower socio-economic status (SES) families to be more prone to non-cognitive delays, and neighbourhoods with low child development might have a higher number of these families. Here, μ_{it}^{T} summarizes factors unobserved by the interviewer that can affect teachers' perceptions, ϵ_{i}^{T} represents an iid error term, and $\Theta_{i,t}^{T}$ represents sources of unobserved heterogeneity not captured by interview measures but potentially related to children's or neighbourhood's average development levels and perceptions. For example, better-educated and more experienced teachers can select in advantaged neighbourhoods and also have better delay-recognition abilities. Importantly, if teachers' benchmarks for what constitutes healthy development depend on the local environment $\bar{D}_{it}^{N}$ in a systematic way, then teachers' evaluations of children's developmental delays are distorted compared to the objective developmental milestones for the population of children of the same age.

Mothers' perceptions about children's developmental delays M_{it} depend on children's true development levels and teachers' perceptions about delays

$$M_{it} = F^{M}(D_{it}, T_{i,t}, X_{it}^{M}) + \mu_{it}^{M}, \quad \text{s.t. } \mu_{it}^{M} = \Theta_{it}^{M} + \epsilon_{it}^{M}, \tag{3}$$

where X_{it}^{M} are observed variables potentially correlated with children's development and perceptions. The shifter $\Theta_{i,t}^{M}$ can include elements of idiosyncratic perceptions of mothers like over-optimism or the lack of involvement, which can be correlated with children's development or teachers' perceptions. For example, teachers might communicate differently with mothers who are uninvolved, and these mothers can also be more likely to have children with lower skill levels. If perceptions of teachers are biased, and perceptions of mothers are affected by perceptions of teachers, then the bias in teachers' judgement will be transmitted to mothers.

Teachers' and mothers' perceptions play a critical role in children's environment (Dizon-Ross, 2019). Formally, the school-based investments, $I_{i,t}^{S}$, are determined by teachers' and mothers' perceptions, while family-based investments, $I^F_{i,t}$, are determined by mothers' perceptions

$$I^S_{i,t} = F^S(M_{it}, T_{it}, X^S_{it}) + \mu^S_{i,t} \text{ s.t. } \mu^S_{i,t} = \Theta^S_{i,t} + \epsilon^S_{i,t}, \tag{4}$$

and

$$I^F_{i,t} = F^F(M_{it}, X^F_{it}) + \mu^F_{i,t} \text{ s.t. } \mu^F_{i,t} = \Theta^F_{i,t} + \epsilon^F_{i,t}. \tag{5}$$

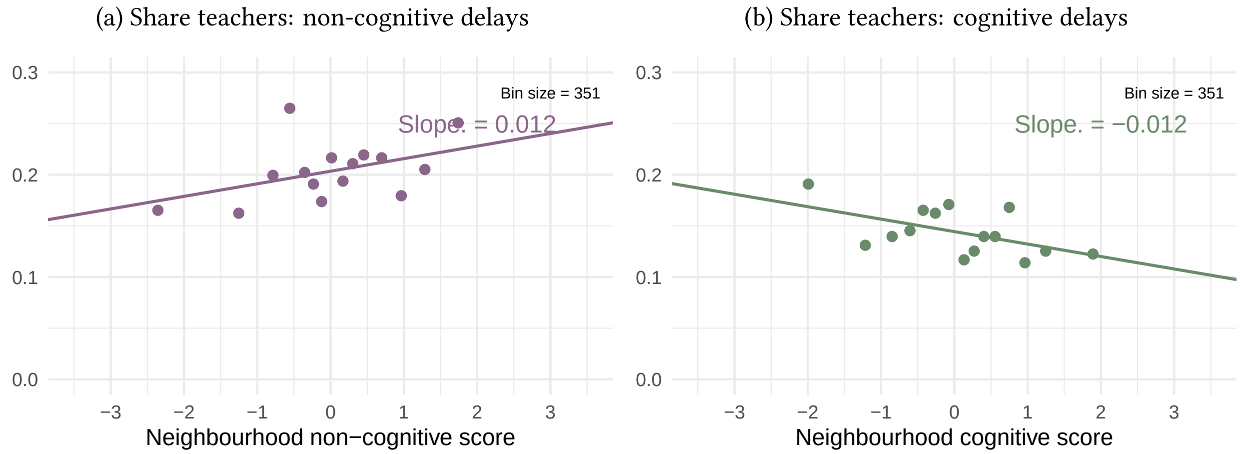
$\Theta^S_{i,t}$ and $\Theta^F_{i,t}$ represent sources of unobserved heterogeneity that are correlated with perceptions and investment by schools and families. Here, $\Theta^S_{i,t}$ can include idiosyncratic determinants of school investments like available resources and $\Theta^F_{i,t}$ can include unobserved determinants of family investment like habits. These shifters can be correlated with perceptions and investment choices, for example, uninvolved mothers can be less likely to recognize delays and habitually invest less in their children. Here, ϵ^F_{it} and ϵ^S_{it} are idiosyncratic measurement errors. If family and school investments depend on how teachers and mothers perceive children's developmental delays, then distortions in perceptions about children have a cascading effect on children's environment, potentially leading to suboptimal investment strategies for children. The following sections describe my estimation strategy and elaborate on the results.

4 Teachers' perceptions and local environment

Teachers' and mothers' subjective perceptions about children's non-cognitive skills are commonly used to compare the levels of development across different groups of children. For example, in Australia, the Australian Early Development Census surveys teachers of children ages 4-5 across the country to identify communities and institutions that are struggling to promote non-cognitive development in children. Subjective perceptions are commonly used in the diagnosis of non-cognitive delays in children.[26] Finally, research on child development commonly relies on teachers' or mothers' subjective perceptions to compare levels of non-cognitive skills across children or across time (Attanasio, De Paula, and Toppeta, 2020, Chaparro, Sojourner, and Wiswall, 2020, Fletcher and Wolfe, 2016, Nghiem, Nguyen, Khanam, and Connelly, 2015). Any

[26] The American Academy of Pediatrics (AAP) recommends that when diagnosing non-cognitive delays healthcare providers ask parents, teachers, and other adults who care for the child about the child's behaviour in different settings, like at home, school, or with peers. See Centers for Desease Control and Prevention.

Figure 3: Average neighbourhood development scores and teachers' perceptions at ages 4-5.



Notes: Panel (a) displays binned scatterplots of the share of children whose teachers perceive non-cognitive delays conditional on the average neighbourhood non-cognitive score. Panel (b) displays binned scatterplots of the share of children whose teachers perceive cognitive delays conditional on on the average neighbourhood cognitive score. Both panels report raw regression lines. The sample includes children ages 4-5 with non-missing interview cognitive and non-cognitive development scores, neighbourhood average development scores, and measures of teachers' perceptions.

reference group bias in perceptions is likely to distort these estimated differences in skills. This section quantifies the role of the reference group in teachers' perceptions using objective measures of child development and average neighbourhood child development levels.

As teachers' perceptions about children's developmental delays are informed by children's development (see Figure 2), it can also be expected that teachers in neighbourhoods with lower average levels of child development are more likely to report developmental delays in children. Panels (a) and (b) of Figure 3 plot the average shares of teachers perceiving developmental delays against the average neighbourhood interview development scores. While Panel (b) shows that teachers perceive fewer delays in more cognitively developed neighbourhoods, Kinsler and Pavan (2021) and Elder and Zhou (2021) have shown that this negative relationship would have been stronger in the absence of the reference bias in teachers' perceptions. Importantly, the relationship between delay recognition by teachers and neighbourhood average development levels is positive for non-cognitive skills. Teachers in neighbourhoods with higher average levels of non-cognitive development measured during the interview are actually more likely to report non-cognitive delays in children. This surprising relationship may be driven by teachers having higher expectations about children's developmental milestones in neighbourhoods where the majority of children are developmentally on track.

To see whether teachers in neighbourhoods with lower levels of child development are less likely to report developmental delays in children, I estimate Equation (2) with a linear functional form. The dependent variable, T_{it}, is a binary variable equal to one if the teacher perceives delay in child i at age t. In the model, D^I_{it} is the objective interview score of child development and $\bar{D}^N_{it}$ is the average neighbourhood level of development. Then

$$T_{i,t} = \beta^{T,N} \bar{D}^N_{i,t} + \beta^{T,D} D^I_{i,t} + \gamma^{T,X}_t X^T_{i,t} + \epsilon^T_{it}, \tag{6}$$

where $\beta^{T,N}$ captures the magnitude of the role of reference group. If teachers' perceptions about child development are based on age-specific developmental milestones, then $\beta^{T,N}$ would be estimated to equal zero, and teachers' perceptions, on average, would reflect the probability that children are delayed relative to the population of similar-aged children. Here X^T_i is a vector of control variables included in all specifications. It contains the child's gender, cohort, age in months, and an index for the socioeconomic status (SES) of the household derived in LSAC, calculated as a weighted composite of parental income, education, and occupational prestige (Baker, Sipthorp, and Edwards, 2017). [27]

Table 1 shows the estimates of the linear probability regression specified by Equation (6). Columns (1) and (3) show the results when only the dedicated development measure is included in the regression. Independent variables include the interview score and the neighbourhood's average development level. The estimates show that teachers are less likely to perceive delays in children who have higher interview development scores, even though they do not observe the interview evaluations of non-cognitive or cognitive development. Columns (2) and (4) show the results taking into account both dimensions of children's development. Teachers' perceptions about child development in both developmental dimensions are affected by both the children's non-cognitive and cognitive development levels. So, children who have higher non-cognitive

[27]The results are robust to controlling for mothers' age, number of siblings, family income, mothers' education, mothers' marital status, whether English is the household language, and mothers' employment status instead of the indicator for SES.

Table 1: Teachers' beliefs and neighbourhood child development levels.

	Non-cognitive delay		Cognitive delay	
Neighbourhood	0.02*	0.02*		0.01*
non-cognitive score	(0.01)	(0.01)		(0.00)
Non-cognitive score	-0.06*	-0.04*		-0.03*
	(0.01)	(0.01)		(0.01)
Neighbourhood cognitive		0.01	0.02*	0.02*
score		(0.01)	(0.01)	(0.01)
Cognitive score		-0.05*	-0.09*	-0.08*
		(0.01)	(0.01)	(0.01)
N	5520	5258	5270	5254
R2	0.05	0.06	0.08	0.09

Notes: Linear probability regression. Control: children's gender, cohort, and age in months, household socioeconomic status (SES) index. Standard errors are clustered at the postcode level. Significance level: * 5%.

skills are less likely to be perceived as having cognitive delays, and children who have better cognitive skills are less likely to be perceived as having non-cognitive delays.

Most importantly, Table 1 shows that the likelihood that teachers perceive developmental delays in children increases with the average level of non-cognitive development in their neighbourhood. This holds for measures of non-cognitive and cognitive delays. In neighbourhoods where children, on average, have lower (higher) interview non-cognitive scores, teachers are less (more) likely to report non-cognitive and cognitive developmental delays conditional on objective measures of children's skills.[28] Further, the average level of cognitive skills in the neighbourhood predicts teachers' recognition of children's cognitive delays, consistent with the findings of Kinsler and Pavan (2021) and Elder and Zhou (2021); however, it does not relate to the recognition of delays in non-cognitive development by teachers.

Columns (2) and (4) of Table 1 also illustrate the limited effect of omitted variable bias on the estimates reported in Columns (1) and (3). This bias can be driven by the Θ_{it}^T in Equation (2), which is potentially unobserved by the interviewer but related both to the children's development and the teachers' perceptions. For example, accounting for the children's cognitive skills in Column (2) in addition to their non-cognitive development slightly reduces the estimates of the role of

[28]Constructing the non-cognitive score and the average neighbourhood non-cognitive score excluding the measure of attention during the interview weakens the relationship between the average neighbourhood non-cognitive development and perceptions about cognitive delays, but not in a statistically significant way. See Appendix C.

children's non-cognitive scores compared to those reported in Column (1) but not in a statistically significant way.

The estimates reported in Table 1 are based on several assumptions. First, I assume linearity of the functional form $F^T(.)$ in Equation (2). Second, I assume that the objective interview score measures latent child development and there are no measurement errors or unobserved heterogeneity in how the skills are measured during the interview (μ^I_{it} in Equation (1)). Table 2 shows that relaxing these assumptions does not change the conclusions from Table 1 that teachers' perceptions depend systematically on the average level of non-cognitive development in the neighbourhood. For example, the estimates reported in Columns (1) and (4) of Table 1 are robust to relaxing the assumption of linearity of $F^T(.)$. Columns (1) and (4) in Table 2 report the average marginal effects of a logistic probability model. The effect of average neighbourhood non-cognitive development on delay recognition by teachers remains positive and statistically significant.

The estimates of Equation (6) reported in Table 1 can also be affected by confounding factors. For example, idiosyncratic shocks to child interview effort correlated with socioeconomic conditions in the neighbourhood (Θ^I_{it} in Equation (1)) may impact how latent development is measured during the interview. Additionally, unobserved determinants of teachers' perceptions (Θ^T_{it}) in Equation (2) like teacher quality can be correlated with neighbourhood development levels.

To control for the potential effect of these confounding factors, I estimate Equation (6) with added controls. To proxy for variation in children's effort during the interview I add controls that are available for the Baby cohort in LSAC, which characterize the behaviour of parents and siblings during the cognitive test. I account for indicators of whether the parent and sibling were not present in the room, present at a distance, observed the child, encouraged the child, or interfered with the tests. I also include a measure of children's sleeping problems and a set of indicators for the month of the interview. To account for the potential selection of better-qualified teachers in more advantaged neighbourhoods, I control for a range of characteristics of children's teachers and classrooms.[29] I control for whether the teacher has a university degree in education (versus

[29]Subsection 4.1 will explore the role of teachers' qualifications and classroom characteristics for developmental delay recognition in greater detail.

diploma or certificate), whether the child is attending daycare (versus kindergarten or preschool), the age range of the children's class reported by the teacher, the ratio of children to qualified staff, and indicators measuring teachers' experience in childcare (0-5 years and 6-10 years versus more than 10 years).[30] Additionally, I account for the neighbourhood characteristics that proxy for potential differences in resources across neighbourhoods that can affect teachers' incentives to perceive a delay. These characteristics are computed based on Census data and include the percentages of children aged 0-4 and 5-9 in the population, percentages of persons with Aboriginal origins, speaking English at home or born in Australia. I control for the neighbourhood's SES using the Index of Relative Socioeconomic Advantage and Disadvantage, which is computed by the Australian Bureau of Statistics.[31] It accounts for a broad range of neighbourhood variables reflecting people's access to material and social resources, and their ability to participate in society (Statistics, 2011). Finally, I include controls for Australian territories to account for potential regulatory differences across early childhood education institutions. Columns (2) and (5) in Table 2 show that these controls have little effect on the estimates of the roles of both the individual non-cognitive score and the average neighbourhood non-cognitive score.

[30] See the summary of additional controls in Appendix A.5. See the summary of teacher and program characteristics as well as the discussion of potential selection of better-quality teachers and programs into more developed neighbourhoods in Appendix A.6.

[31] See the summary of neighbourhood characteristics in Appendix A.3.

Table 2: Robustness checks

	Non-cognitive delay			Cognitive delay		
	(1)	(2)	(3)	(4)	(5)	(6)
	Logit Avg. Marg. Effect	Extra controls	Meas. error adj.	Logit Avg. Marg. Effect	Extra controls	Meas. error adj.
Neighbourhood	0.019*	0.020*	0.050*	0.012*	0.019*	0.025*
non-cognitive score	(0.006)	(0.009)	(0.013)	(0.005)	(0.007)	(0.010)
Non-cognitive score	-0.037*	-0.035*	-0.386*	-0.023*	-0.030*	-0.161
	(0.006)	(0.011)	(0.112)	(0.005)	(0.011)	(0.087)
Neighbourhood cognitive	0.010	0.001	0.003	0.016*	0.001	0.029*
score	(0.006)	(0.012)	(0.018)	(0.005)	(0.010)	(0.013)
Cognitive score	-0.050*	-0.074*	-0.045	-0.077*	-0.087*	-0.155*
	(0.006)	(0.011)	(0.067)	(0.005)	(0.011)	(0.052)
N	5258	1914	5215	5254	1914	5211
R2		0.08	.		0.12	.

Notes: All columns control for children's gender, cohort, and age in months, household socioeconomic status (SES) index. Columns (1) and (4) report marginal effects of logistic probability model estimates. Columns (2) and (5) report the linear probability regression with added controls for sleeping problem intensity, age of the youngest in the class, age of the oldest in the class, whether the child attends daycare, the behaviour of parents and siblings during the test, the month of the interview, teachers' and classroom characteristics, Australian territory, and neighbourhood characteristics from Census. Standard errors are clustered at the postcode level. Columns (3) and (6) report linear probability model TSLS estimates adjusted for the measurement error in children's development. Instruments for focus during cogn. test: positive and negative behaviour during the interview. Instrument for PPVT: WAI. Standard errors are clustered at the postcode level. Significance level: * 5%

The estimates of Equation (6) reported in Table 1 also abstract from the potential measurement error in the interview development scores (ϵ_{it}^{I}) described in Equation (1). To explore the role of measurement error, I estimate a TSLS version of the regression in Equation (6) using children's focus during the cognitive test as the main measure of non-cognitive skills, instrumenting it with the degrees of positive and negative response during the interview. Similarly, I use the PPVT score as the main measure of cognitive skills and instrument it with the WAI score, with all measures age-standardized. Columns (3) and (6) in Table 2 show that measurement error has a substantial effect on the estimates, with the bias distorting estimates of both the children's individual development and the role of the neighbourhood's average development levels towards zero. Adjusting for measurement error strengthens the estimated effects of both children's own development and average neighbourhood development on teachers' perceptions.[32]

Next, I explore the implications of estimated magnitudes of the role of reference groups for the gaps in teachers' delay recognition between less- and more-advantaged areas. First, I predict the probabilities of teachers perceiving delays based on estimates reported in columns (2) and (4) of Table 1. Panels (a) and (b) in Figure 4, plot these predicted probabilities of teachers perceiving delays against the average neighbourhood development level. The simple linear probability model replicates the patterns in Figure 3 with a positive relationship between the predicted probability to perceive non-cognitive delays and average neighbourhood development level, and a weakly negative relationship between the predicted probability to perceive cognitive delays and average neighbourhood development level.

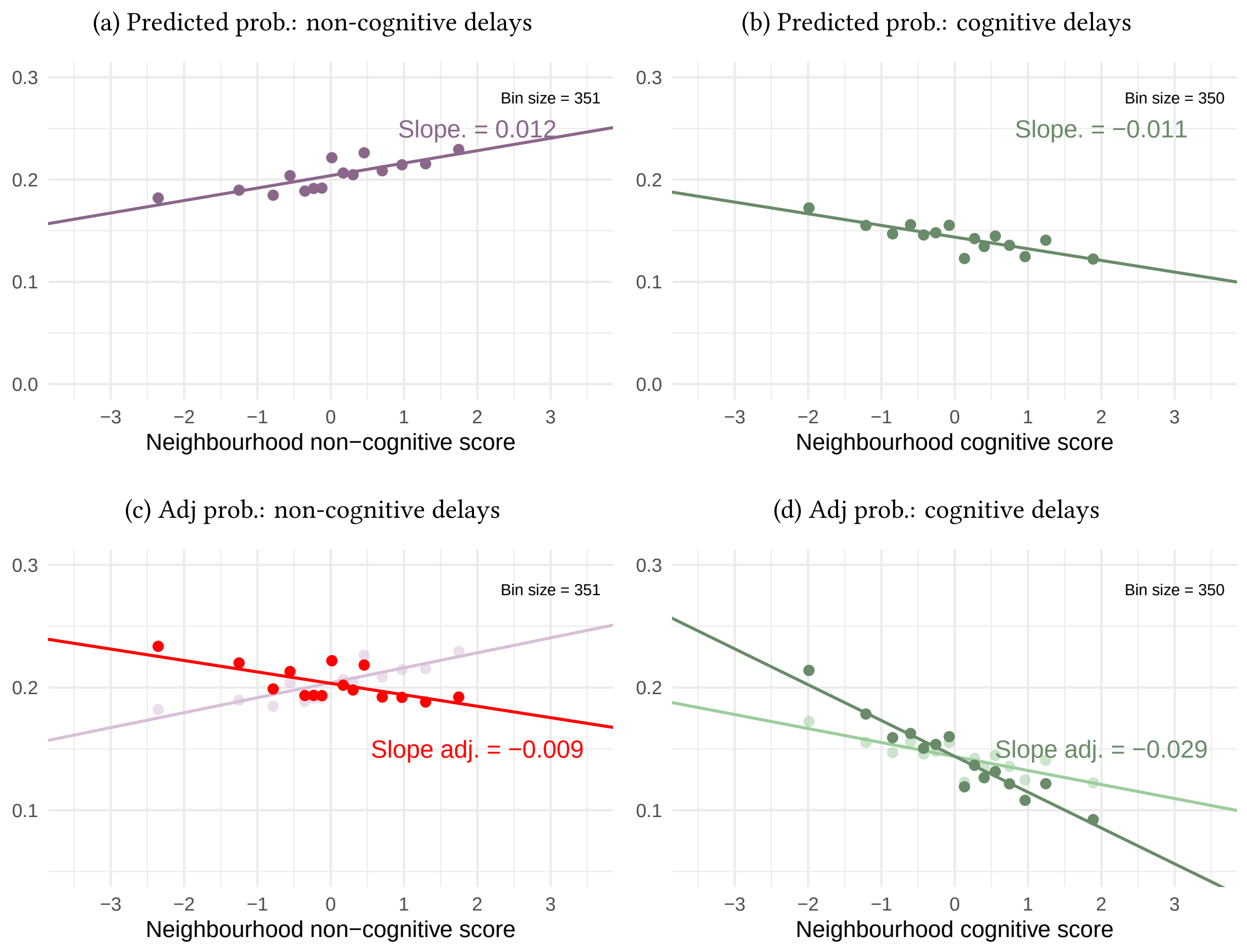
To quantify the implications of the impact of reference group, I predict a counterfactual probability of teachers perceiving delays while removing the influence of the reference group. To do so, I predict the probabilities of teachers perceiving delays based on estimates reported in columns (2) and (4) while setting the average neighbourhood cognitive development levels equal to the population mean (zero) values. This exercise removes the direct effect of neighbourhood average development levels on teachers' perceptions. Panels (c) and (d) in Figure 4 plot binned

[32]Additional robustness checks exploring the role of measurement error in the neighbourhood average measure of child development, sensitivity to the chosen method of constructing the child's non-cognitive score and average neighbourhood score, and sensitivity to the choice of the measure of teachers' perceptions about non-cognitive development do not change the conclusion about the role of average neighbourhood non-cognitive development for perceptions about non-cognitive delays. See Appendices C, E, and D.

scatterplots of these adjusted probabilities against the average neighbourhood development levels. Panel (c) shows that adjusting for the reference bias in teachers' perceptions about children's non-cognitive delays changes the sign of the relationship between teachers' perceptions and average neighbourhood non-cognitive development level, making it negative. This negative relationship is driven by the selection of children with lower measured development and less advantaged family characteristics (as captured by control variables) into neighbourhoods with lower average levels of child development.

In the data, teachers in neighbourhoods at the top quartile of average non-cognitive development are 1.4 percentage points more likely to perceive non-cognitive delays compared to teachers in bottom-quartile neighbourhoods. By contrast, the adjusted probability of perceiving non-cognitive delays is 2.7 percentage points lower for teachers in top-quartile neighbourhoods compared to teachers in bottom-quartile neighbourhoods. Moreover, adjusting for the role of reference group in teachers' perceptions using the estimates adjusted for measurement error (column (3) of Table 2) increases the magnitude of this gap to 10 percentage points. Similarly, adjusting for the reference bias using the estimates reported in column (4) of Table 1 increases the magnitude of the gap in reports of cognitive delays between top and bottom quartiles of neighbourhoods in terms of cognitive development from 1.9 to 6.8 percentage points. Using the estimates adjusted for measurement error further increases the magnitude to 10.1 percentage points.

Figure 4: Average neighbourhood development scores and predicted teachers' perceptions at ages 4-5.



Notes: Panels (a) and (b) report the binned scatterplot of the predicted probabilities for children's teachers to perceive developmental delays conditional on the average neighbourhood development score (based on estimates reported in columns (2) and (4) in Table 1). Panel (a) displays binned scatterplots of predicted probability that children's teachers will perceive non-cognitive delays conditional on the average neighbourhood non-cognitive interview development score. Panel (b) displays binned scatterplots of predicted probability that children's teachers will perceive cognitive delays conditional on the average neighbourhood cognitive interview development score.

Panels (c) and (d) report the binned scatterplot of counterfactual predicted probabilities to perceive developmental delays adjusted for the role of the reference group. The adjusted probabilities are constructed by predicting the probability while setting average neighbourhood child development levels to the mean (zero) value. Panel (c) displays binned scatterplots of the adjusted probability to perceive non-cognitive delay conditional on the average neighbourhood non-cognitive interview development score. Panel (b) displays binned scatterplots of the adjusted probability of perceived cognitive delays conditional on the average neighbourhood cognitive interview development score. All panels plot raw regression lines.

4.1 Teachers' quality and delay recognition

The quality of early childhood education has been shown to have a lasting impact on children's outcomes (Heckman, Pinto, and Savelyev, 2013). It is important to understand what factors might help reduce the bias in teachers' perceptions. An extensive literature concerned with the role of early childhood education instructor quality for student outcomes explores the role that teacher qualifications as well as classroom characteristics play in determining student progress.[33] I explore whether teacher qualifications, as measured by education or experience, or classroom characteristics, as measured by the type of childcare arrangement, class size or age composition, help teachers identify children with low levels of development.

Early childhood education and care in Australia is governed by a mix of state/territory regulations and national frameworks. Compulsory schooling in all territories other than Tasmania begins when children are 6 years old, therefore, children ages 4-5 in the sample attend early childhood education care, including preschools, kindergartens, and daycare. The majority of children in the sample attend preschool or kindergartens, with 26 percent of them attending daycare (see Appendix A.7).[34]

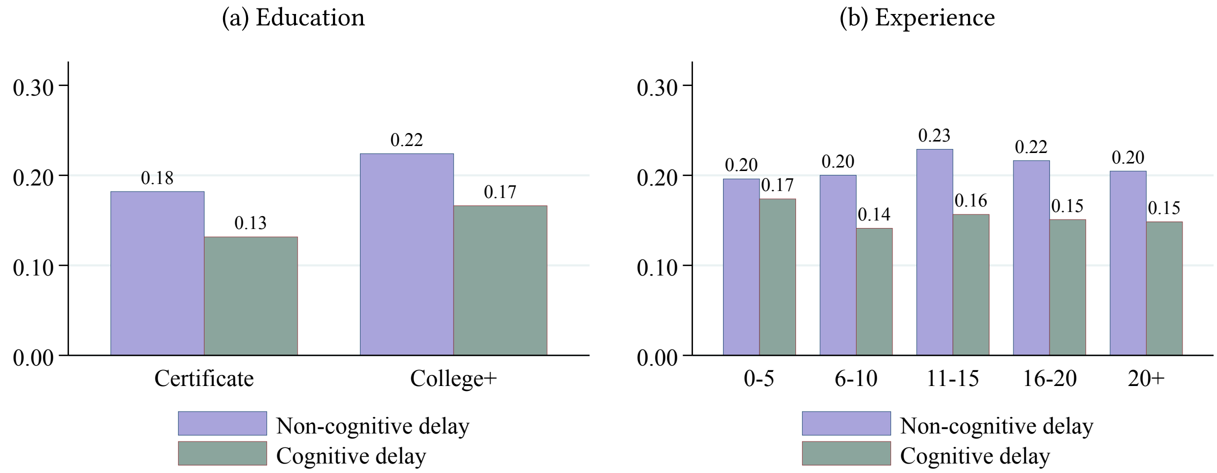
In Australia, there are two pathways to becoming an early childhood instructor. One is to obtain a college degree in early childhood education, which allows employment as an early childhood teacher. Another is to become an early childhood educator by obtaining relevant diplomas or certificates from Registered Training Organisations, which typically take one to two years to complete. Overall, 36 percent of instructors in the sample do not hold college degrees in early childhood education.[35] This allows me to evaluate whether instructors with different levels of training differ in their perceptions of children's delays. Figure 5 shows the probability of teachers perceiving cognitive and non-cognitive delays in children conditional on their qualifications. Panel (a) of Figure 5 shows that early childhood teachers with a university degree in education are 4 percentage points more likely to perceive delays in non-cognitive development and 3.6 percent-

[33]See Manning, Wong, Fleming, and Garvis (2019) for review of research on the role of instructors' qualifications.

[34]The use of early childhood education in Australia is subsidized. In 2004 and 2008, when children in my sample were ages 4 to 5, the childcare costs for families were subsidized through the mean-tested Child Care Benefit program available to both working and non-working families. Some families were additionally eligible for the Child Care Rebate conditional on satisfying the work, training, and study test.

[35]See Appendix A.6 for the summary of teachers' qualifications.

Figure 5: Share of teachers perceiving delays in children ages 4-5 by teachers' characteristics.



Notes: Panel (a) shows the average share of teachers perceiving delays in cognitive and non-cognitive development by teacher's education. Panel (b) shows the average share of teachers perceiving delays in cognitive and non-cognitive development by teacher's work experience in childcare.

age points more likely to perceive delays in cognitive development compared to teachers with certificates and diplomas. Moreover, Panel (b) of Figure 5 shows that the likelihood of instructors perceiving delays remains relatively stable across their careers. The likelihood of perceiving delays in non-cognitive development has an inverted U-shape, peaking when instructors have 11 to 15 years of experience. By contrast, for cognitive development inexperienced instructors are most likely to report delays. These differences in the rates of perceiving delays can be driven by some instructors being more effective in recognizing low development in children, or by them reporting more delays overall.

Table 3 explores whether teacher or classroom characteristics matter for teachers' recognition of low development levels. For each dimension of development, I split the sample into subsamples with low- and high- measured levels of development based on the objective interview development scores. The subsample of children with low measured non-cognitive (cognitive) development consists of children whose interview non-cognitive (cognitive) score falls within the first quartile of score distribution for the sample of children ages 4-5. Similarly, the subsample of children with high measured development includes children with measured development in the top quartile. Intuitively, children with the lowest measured development are more likely to have developmental delays.[36] Next, I estimate the linear probability regression separately for two subsamples, $J = \{H, L\}$:

$$T_{i,t} = \beta^{J,V} V_{i,t}^T + \gamma_t^{J,X} X_{i,t}^T + \epsilon_{it}^T,$$

where X_i^T is a vector of control variables included in all specifications. It contains the child's gender, cohort, age in months and an index for socioeconomic status (SES). Here $V_{i,t}^T$ includes observed teacher and classroom characteristics that can be associated with the quality of early childhood education.[37] In particular, I account for whether the teacher has a university degree in education (versus diploma or certificate), whether the child is attending daycare (versus kindergarten or preschool), the age range of children in class reported by the teacher, the ratio of children to qualified staff, and indicators measuring teachers' experience in childcare (0-5 years and 6-10 years versus more than 10 years).

Teacher education is positively associated with delay recognition for subsamples of children with low measured levels of development. Teachers with bachelor's or postgraduate university degrees in education are 9.1 percentage points more likely to perceive delays in non-cognitive skills for the subsample of children with low measured non-cognitive development compared to educators with diplomas or certificates. They are also 6.6 percentage points more likely to perceive cognitive delays for the subsample of children with low measured cognitive development. As can be expected, this relationship is not evident for children with high measured development, where more extensive training should not increase the likelihood of delay recognition.

For the subsample with low measured non-cognitive development, inexperienced teachers with less than 5 years of experience are 10.1 percentage points less likely to perceive non-cognitive delays compared to teachers with more than 10 years of experience. A further increase in experience is not associated with gains in the probability of delay recognition. This penalty for the lack of experience in delay recognition is not noticeable for cognitive delays. This may reflect the fact that teachers persistently sort into low-development or high-development areas. In that case, working extra years does not expand the teacher's reference group to include children

[36]For example, in 2023 in Australian schools accommodations due to predominantly cognitive and non-cognitive deficits were offered to 24.2% of students. The results in this section are robust to dividing children into subsamples with measured development above and below the sample median score.

[37]These characteristics include teacher and classroom qualities used as controls for the estimation reported in columns (2) and (5) of Table 2.

Table 3: Teachers' and classroom characteristics and perceived delays in children ages 4-5

	Non-cognitive delay		Cognitive delay	
	(1)	(2)	(3)	(4)
	Non-cogn. score low	Non-cogn. score high	Cogn. score low	Cogn. score high
Teacher college+	0.091*	0.022	0.066*	0.005
	(0.027)	(0.022)	(0.026)	(0.014)
Child attends daycare	-0.042	0.000	-0.030	-0.001
	(0.033)	(0.027)	(0.028)	(0.018)
Teaching experience 0-5 years	-0.101*	0.004	0.007	0.046
	(0.032)	(0.030)	(0.033)	(0.025)
Teaching experience 6-10 years	-0.043	-0.026	-0.044	0.031
	(0.030)	(0.025)	(0.030)	(0.020)
Age of youngest in class	0.002	0.002	0.003	0.002
	(0.002)	(0.001)	(0.002)	(0.001)
Age of oldest in class	0.001	0.001	0.002	0.001
	(0.002)	(0.001)	(0.002)	(0.001)
Children to qualified staff ratio	-0.002	0.002	0.002	0.001
	(0.002)	(0.002)	(0.002)	(0.001)
N	1396	1317	1310	1120
R2	0.07	0.03	0.05	0.03

Notes: Linear probability regression for high-development (measured development bottom quartile) and low-development (measured development top quartile) samples. Control: children's gender, cohort, and age in months, household socioeconomic status (SES) index. Standard errors are clustered at the postcode level. Significance level: * 5%.

with different levels of skills. By contrast, being exposed to university training can improve the ability of teachers to correctly identify children with delays even in neighbourhoods with low average child development levels. Other classroom characteristics, like class size as measured by the children-to-qualified-staff ratio or the age composition of the class, do not have a robust relationship with delay recognition.

Next, I explore how the role of the reference group differs between instructors with different education levels. Table 4 reports estimates of Equation (6) estimated separately for the subsamples of educators with certificates or diplomas, and teachers with undergraduate or postgraduate degrees in education. All regressions additionally control for the set of instructors' and classroom characteristics. One noticeable difference in the estimates is that teachers with a university degree have a stronger association between perceived delays and children's own measured development. One possible interpretation of this may be that the teachers who receive university training become more equipped to recognize children's developmental trajectories.

Teachers' professional judgement plays a critical role in facilitating children's learning.

Table 4: Teachers' education and the role of reference group

	Non-cognitive delay		Cognitive delay	
	(1)	(2)	(3)	(4)
	Certificate	College+	Certificate	College+
Non-cognitive score	-0.032*	-0.055*	-0.031*	-0.035*
	(0.011)	(0.009)	(0.011)	(0.008)
Neighbourhood non-cognitive score	0.015	0.027*	0.020*	0.016*
	(0.010)	(0.008)	(0.008)	(0.007)
Cognitive score	-0.031*	-0.067*	-0.061*	-0.098*
	(0.012)	(0.009)	(0.009)	(0.008)
Neighbourhood cognitive score	0.003	0.007	0.011	0.017*
	(0.010)	(0.009)	(0.008)	(0.008)
N	1696	2871	1693	2871
R2	0.05	0.08	0.08	0.12

Notes: Linear probability regression for subsamples of teachers with certificates of diplomas or undergraduate and postgraduate degrees in education. Control: children's gender, cohort, and age in months, household socioeconomic status (SES) index, whether the child is attending daycare (versus kindergarten or preschool), the age range of the children's class reported by the teacher, the ratio of children to qualified staff, and indicators measuring teachers' experience in childcare (0-5 years and 6-10 years versus more than 10 years). Standard errors are clustered at the postcode level. Significance level: * 5%.

For example, the Early Years Learning Framework published by the Australian Government Department of Education emphasizes the fundamental role that teachers' assessments play in the effective planning of children's learning, communicating about children's progress, determining the extent to which all children are progressing toward their learning outcomes, and identifying children who need additional support (Australian Government Department of Education, 2009). The bias in teachers' evaluations is likely to distort all of these processes, generating a cascading effect on parental perceptions and children's learning environments. In the next sections, I shed light on this cascading effect by showing, first, that teachers' perceptions of child development affect parental perceptions, and, second, that the judgement of parents and teachers about child development alters children's learning environments.

5 The influence of teachers' perceptions on mothers

Teachers are often a key source of information for parents trying to monitor their children's progress. This section investigates whether biased teachers' perceptions about child development are likely to be transmitted to parents. To explore the connection between teachers' and mothers' perceptions, I utilize the measures of mothers' and teachers' perceptions of child non-cognitive development, and objective measures of child development available for ages 4-5 and 8-9.

I estimate a linear probability regression where the dependent variable is equal to one if the mother has indicated her child to be more difficult than other children of similar age (M_{it}).

$$M_{it} = \beta^{MD} D^I_{it} + \beta^{MT} T_{it} + \gamma^{MX} X^M_{it} + \epsilon^M_{it}, \quad (7)$$

where X^M_i - is a vector of controls including children's gender, cohort, age in months, the index for the socioeconomic status (SES) of the household, and mothers' depression levels. Some specifications additionally control for the lag of mother perceptions and mothers' level of involvement at school as reported by teachers when this measure is available. T_{it} is a measure of teachers' perceptions of delays, where I explore different available measures of teachers' perceptions for children ages 4-5 and for children ages 8-9.

Columns (1) and (2) in Table 5 show the relationship between mothers' delay recognition and teachers' perceptions when children ages 4-5. All variables for these specifications are measured when children are ages 4-5. I use teachers' non-cognitive or cognitive delay recognition analyzed in Section 4 to measure teachers' perceptions. Mothers of children whose teachers indicate developmental delays in the non-cognitive dimension are indeed more likely to think that their children have non-cognitive delays conditional on children's interview development measures. Column (2) additionally controls for the lag of maternal perceptions measured when children are ages 2-3.[38] The lag of maternal perceptions accounts for persistent elements of unobserved heterogeneity in perceptions that can be correlated with factors affecting the transmission of teachers' perceptions represented by Θ^M_{it} in Equation (3). This can be driven by different valuations of skills, over-optimism, and the lack of involvement. If teachers indicate non-cognitive delays in children's development, mothers are 8 percentage points more likely to also indicate that their children are delayed in development. However, this association does not necessarily imply that teachers' perceptions transfer to parental perceptions about children's non-cognitive

[38]Since the first age of observations for the kindergarten cohort in LSAC is 4-5, this regression can only be estimated for the baby cohort followed from ages 0-1.

Table 5: Mothers' and teachers' perceptions

	Non-cognitive delay perceived by mother			
	(1)	(2)	(3)	(4)
	Ages 4-5	Ages 4-5	Ages 8-9	Ages 8-9
Teach.: Non-cognitive delay	0.096*	0.080*		
	(0.013)	(0.020)		
Teach.: Cognitive delay	0.042*	0.020		
	(0.015)	(0.021)		
School contacted about behavior			0.180*	0.115*
			(0.015)	(0.015)
Non-cognitive score	-0.021*	-0.020*	-0.024*	-0.015*
	(0.005)	(0.007)	(0.004)	(0.004)
Cognitive score	-0.004	0.002	-0.012*	-0.005
	(0.004)	(0.006)	(0.004)	(0.003)
Mother depression	0.028*	0.021*	0.023*	0.016*
	(0.004)	(0.006)	(0.003)	(0.003)
Lag mother: Non-cognitive delay		0.313*		0.510*
		(0.044)		(0.026)
Index: mothers' interactions with school				0.003
				(0.003)
N	4733	2228	7261	5561
R2	0.06	0.13	0.08	0.30

Notes: Linear probability regression. Control: children's gender, cohort, and age in months, household socioeconomic status (SES) index, mothers' depression score. Standard errors are clustered at the postcode level. Significance level: * 5%

development since mothers' and teachers' perceptions about children's development are likely to affect each other. For example, mothers of children diagnosed with ASD or ADHD can contact teachers to inform them about the developmental needs of their children.[39]

To address the reverse causality problem, I take advantage of the LSAC question available for children 8-9 years old asking mothers whether, in the last 12 months, the school has contacted them about the child's behaviour. This represents a direct information transfer from teachers to parents that signals delays in children's non-cognitive development. For children ages 8-9, columns (3) and (4) of Table 5 show that mothers update their beliefs about children's non-cognitive delays after being contacted by the school. Column (4) additionally controls for the lag of mothers' perceptions measured when children were ages 6-7 and the level of mothers' involvement at school as reported by teachers.[40] These variables proxy for differences in incentives of schools to contact mothers with different levels of engagement. For example, schools might not need to contact mothers who maintain constant communication with teachers. Similarly, teachers might be more reluctant to contact mothers who seem uninvolved in children's education. Column (4) reports that being contacted by the school in the last 12 months increases the probability that mothers perceive their children to be more difficult than others by 11.5 percentage points.

This section shows that teachers' judgement affects parental perceptions about children's non-cognitive skills. While teachers' evaluations of academic progress are expected to inform parental knowledge (Dizon-Ross, 2019, Doss, Fahle, Loeb, and York, 2019), the role of teachers in parental learning about children's non-cognitive development is less understood. The estimated impact of communication between teachers and parents in the presence of bias in teachers' assessments implies that parental perceptions are affected. Any distortions can be transmitted to child environments through the optimal investment choices of teachers and parents. The next section studies the relationship between non-cognitive delay recognition in children and investment into skills, educational aspirations and parental attitudes.

[39]From columns (1) and (2) it also follows that mothers with more depressive symptoms are more likely to perceive their child to be more difficult than other children, similar to the findings of Del Bono, Kinsler, and Pavan (2020).

[40]The index of mothers' involvement at school is computed by LSAC based on subquestions measuring parents' interactions with school. Parents' interactions include contacting the teacher, visiting the child's class, volunteering in class, helping in school, attending parent-school committees, raising funds, and participating in other activities.

6 Teachers' perceptions and school environment

Both families and schools can undertake investments in children who are falling behind. This section investigates the relationship between teachers' and mothers' perceptions of developmental delays and community investments in children. I focus on the neighbourhood- or school-level investment into different types of child therapy, which represents an important compensatory investment available to schools and families.

I explore whether delays perceived by teachers and mothers when children are 4-5 years old predict the therapy uptake at ages 6-7. I focus on the uptake of two types of therapy: one focused on cognitive skills (learning or speech therapy) and another focused on non-cognitive skills (behavioural or psychological therapy). To understand the role of teachers' perceptions in the uptake of therapy, I estimate the linear probability regression where the dependent variable is equal to one if the child receives therapy ($I_{it}^S = \{0{,}1\}$) at ages 6-7, and the independent variables include the teachers' and maternal perceptions about children's developmental delays at ages 4-5 (T_{it-1} and M_{it-1})

$$I_{it}^S = \beta^{ST} T_{it-1} + \beta^{SM} M_{it-1} + \gamma_t^{SX} X_{it}^S + \epsilon_{it}^S. \tag{8}$$

I address the potential endogeneity of perceptions about children in several ways. First, I use *lagged* teachers' and mothers' perceptions at ages 4-5 as independent variables. This addresses the potential reverse causality problem with the change in perceptions driven by the uptake of therapy. Second, I control for confounding factors by including the vector of controls X_{it}^S with children's gender, cohort, age in months, and the index for the socioeconomic status (SES) of the household measured when children are ages 6-7. Moreover, I control for the neighbourhood characteristics computed based on the Census data and Australian territory to proxy for potential differences in the supply of therapy services. Finally, I account for children's lagged non-cognitive and cognitive scores measured at 4-5, as well as lagged therapy uptake at 4-5 to account for individual-specific heterogeneity, habits, and history of past inputs using the value-added approach (Fiorini and Keane, 2014, Todd and Wolpin, 2007).

Columns (1) and (3) of Table 6 show the estimates of Equation (8) for therapy directed at non-cognitive and cognitive development, respectively. Perceptions about children's non-

Table 6: Perceived delays by teachers and mothers and child therapy

	Non-cogn. therapy at 6-7		Cogn. therapy at 6-7	
	(1)	(2)	(3)	(4)
Teach.: Non-cognitive delay at 4-5	0.048*	0.039*	0.050*	0.031*
	(0.012)	(0.012)	(0.015)	(0.014)
Teach.: Cognitive delay at 4-5	-0.004	-0.006	0.097*	0.058*
	(0.014)	(0.014)	(0.020)	(0.019)
Moth.: Non-cognitive delay at 4-5	0.178*	0.155*	0.109*	0.078*
	(0.026)	(0.026)	(0.025)	(0.024)
Moth.: Concern cognitive delay at 4-5	0.047*	0.039	0.131*	0.077*
	(0.020)	(0.020)	(0.025)	(0.023)
Therapy non-cogn. at 4-5		0.143*		
		(0.030)		
Therapy cogn. at 4-5				0.251*
				(0.019)
N	4796	4796	4796	4796

Notes: Linear probability regression. Controls: children's gender, cohort, age in months, household socioeconomic status (SES) index, neighbourhood characteristics from the Census, and Australian territory dummies. Columns (2) and (4) additionally control for non-cognitive and cognitive score at 4-5 and the lag of therapy uptake. Standard errors are clustered at the postcode level. Significance level: * 5%

cognitive delays by teachers are an important predictor of children taking advantage of both non-cognitive and language-oriented therapy. Teachers' perceptions about delays in language development are an important predictor of children receiving learning support or speech therapy, but not behavioural therapy or psychological assessment. Columns (2) and (4) additionally control for the lag of therapy uptake and lagged interview development scores. Children whose teachers indicate non-cognitive delays are almost 4 percentage points more likely to receive behavioural therapy as well as 3 percentage points more likely to receive learning or speech therapy. In addition to the teachers' perceptions, the mothers' perceptions about children's non-cognitive delays predict the uptake of both types of therapy. Mothers' perceptions about non-cognitive delays in children are the strongest predictor of the child's use of non-cognitive therapy.[41]

To an important degree, the uptake of therapy services is predicted by the perceptions of teachers and mothers about children's development. Because teachers in advantaged neighbourhoods are more likely to perceive children's developmental delays (shown in Section 4) and these perceptions are transmitted to parents (shown in Section 5), the reference bias is likely to exaggerate the gaps in the therapy uptake between children in advantaged and disadvantaged areas.

7 Mothers' perceptions and family environment

In addition to the uptake of therapy services, mothers who think that their children are falling behind are likely to undertake different parental investment strategies. I explore the relationship between mothers' perceptions about children's non-cognitive delays when children are aged 8-9, and a wide range of family investments and attitudes measured when children are 10-11 including the uptake of community parenting resources, parenting style, frequency of household members engaging in development-promoting activities like reading to or with their child, parental expectations about their children's future, and tutoring.

To understand the role of mothers' perceptions for family investment choices, I estimate

[41] Appendix F discusses the heterogeneity of the relationship between school environment and perceptions by mother's education. It corroborates the role of teachers' perceptions for the therapy uptake for children from more- and less-educated families.

Table 7: Delays perceived by mothers and family investments for children ages 10-11

	Mother: child more difficult at 8-9			
Dependent variable at 10-11:	Coef.	SE	N	R2
A. Uptake of professional services last 12 months				
Used parenting education courses or programs	0.05*	(0.01)	6628	0.04
Used parent support groups|helplines	0.05*	(0.01)	6628	0.06
Tutor times per week	0.10*	(0.03)	3314	0.16
B. Parental attitudes and quality of interactions				
Mother Warmth Score [SD]	-0.15*	(0.04)	6628	0.47
Mother Anger Score [SD]	0.28*	(0.04)	6626	0.44
Mother expects child coll+	-0.07*	(0.03)	3079	0.41
C. Weekly quality time investment				
Read to child	0.38*	(0.13)	3293	0.16
Talk about school	-0.06	(0.05)	6585	0.10
Mom childcare time	-0.68	(0.97)	3329	0.11
Dad childcare time	-0.17	(0.75)	1757	0.21

Notes: Linear regression. Control: children's gender, cohort, and age in months, household socioeconomic status (SES) index, neighbourhood characteristics from the Census, Australian territory dummy, mothers' depression score, lag of non-cognitive and cognitive scores, lag of the dependent variable. Standard errors are clustered at the postcode level. Significance level: * 5%.

a linear regression where the dependent variable is equal to various measures of family-based investment when children are ages 10-11 (I_{it}^F), and the independent variables include the lag of mothers' perceived non-cognitive developmental delays for children ages 8-9 ($M_{i,t-1}$)

$$I_{i,t}^F = \beta^{F,M} M_{it-1} + \beta_t^{F,X} X_{it}^F + \beta^{F,I} I_{i,t-1}^F + \epsilon_{i,t}^F, \tag{9}$$

Following the estimation approach described in Section 6 I address the potential endogeneity of parental perceptions by using the lag of mothers' perceptions as an independent variable to address the reverse causality problem and adopting a value-added approach with a range of controls for potential confounding factors. A vector of controls, X_{it}^F, includes children's gender, cohort, age in months, and the index for the socioeconomic status (SES) of the household. Control variables also include mothers' depressive symptoms score, neighbourhood characteristics, Australian territory, lagged non-cognitive and cognitive scores, and lagged investment $I_{i,t-1}^F$. The standard errors are clustered at the postcode level.

Table 7 shows the estimates of Equation (9) estimated for various home environment characteristics when children are ages 10-11. Delays perceived by mothers when children are 8-9 predict two noticeable types of parental responses. Part A of the table shows that, on the one hand, mothers who perceive delays are more likely to engage in compensatory investment. They are more likely to use parenting education courses and programs, parental support groups and helplines, they also hire more tutoring for the child similar to the findings of Kinsler and Pavan (2021). Combined with the increased use of therapy services, this implies that parents who identify delays in children are more likely to reach out for professional help for their children. On the other hand, Part B shows that mothers who recognize children's non-cognitive delays have different attitudes toward their children. They report using less warm and more angry parenting practices. In addition to the change in parenting, mothers report having lower aspirations about their children's future education. Mothers who think that their children have a non-cognitive delay are 7 percentage points less likely to expect that their children will obtain a university education.[42]

Mothers' misperceptions about children are likely to undermine children's developmental trajectories. Parental attitudes have been shown to be important for children's non-cognitive development (Fiorini and Keane, 2014, Falk, Kosse, Pinger, Schildberg-Hörisch, and Deckers, 2021), therefore, overestimation of delays in non-cognitive development can have a detrimental effect on children through the decrease in parenting quality. On the other hand, in the presence of evidence on the effectiveness of school-based social and emotional learning programmes the underestimation of delays by teachers and parents will reinforce existing gaps in non-cognitive skills across less- and more-advantaged areas.[43]

8 Conclusions

In this paper, I explore the effect of the local environment on teachers' and mothers' perceptions of developmental delays in children. Using data from direct non-cognitive development

[42]See Appendix F for the discussion of the heterogeneity of the relationship between home environment and perceptions by mother's education.

[43]See Kautz, Heckman, Diris, Ter Weel, and Borghans, 2014 for a review of interventions directed at non-cognitive skills.

observations collected by LSAC interviewers, I document that teachers in neighbourhoods where non-cognitive delays are more prevalent are less likely to perceive non-cognitive and cognitive delays conditional on objective measures of child development. This implies that the inequality in teachers' perceptions of non-cognitive or cognitive skills significantly underestimates the true gaps in child development.

I show that these misperceptions matter beyond obtaining the correct statistics. Children whose teachers and parents do not recognize their delays in development are less likely to receive professional help like behavioural or learning therapy, or tutoring. Parental attitudes are also affected, and the overestimation of delays is associated with lower educational aspirations and worse parent-child interactions.

An important direction for future research is exploring various ways to improve the recognition of delays by teachers and families. To address bias in the assessment of academic skills, educational authorities in many countries are conducting standardized nationwide testing of numeracy and literacy, for example, the National Assessment of Educational Progress in the U.S. or the National Assessment Program – Literacy and Numeracy in Australia. These programs provide both parents and schools with an opportunity to learn about children's true positions in the distribution of cognitive skills for similar-aged children. However, they are expensive and have been shown to depend on multiple factors beyond cognitive skills, including students' effort and test-taking skills(Heckman and Kautz, 2012). Standardized assessments of non-cognitive skills are costly for both governments and students.

A more efficient approach may be providing training to teachers. I show that in the early childhood program setting, college degrees in education are associated with higher delay recognition. Providing psychologist-regulated training allowed interviewers in the LSAC study to collect measures of behaviour for a population of children. Similarly, providing better information about developmental milestones and details of skill accumulation at every childhood stage may allow teachers to assess their students more objectively. In a similar vein, asking teachers to evaluate students based on direct observations and using clear assessment guidelines and objective scales may ameliorate the reference bias in the teachers' assessments.

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A Additional data description

A.1 Measures of child development and perceptions

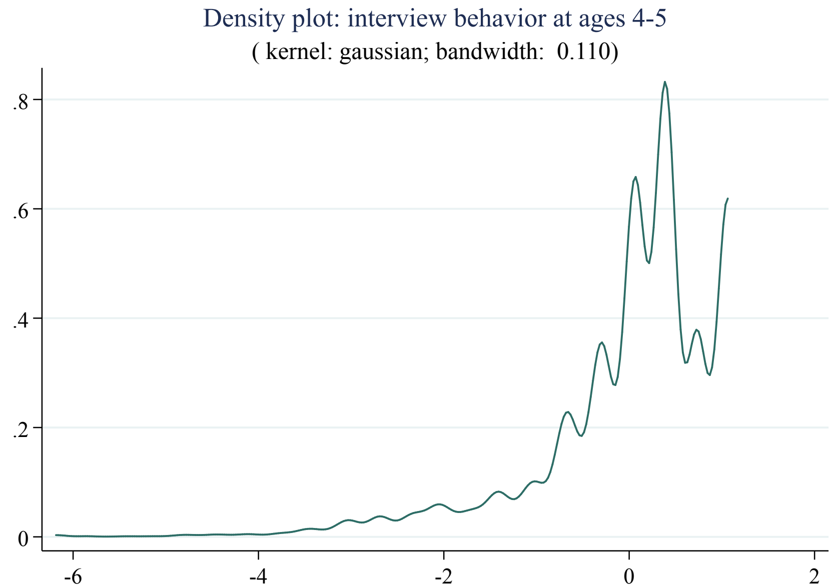


Figure A.1: Distribution of non-cognitive score at ages 4-5

Table A.1: Measures of children's development and perceptions about children by their age

	Ages 4-5			Ages 8-9		
	N	Mean	SD	N	Mean	SD
Teacher: cognitive delay	6598	0.15	0.36			
Teacher: non-cognitive delay	6604	0.21	0.41			
Mother: Non-cognitive delay	7144	0.07	0.25	7788	0.07	0.26
Mother: cognitive concern	9365	0.08	0.27			
Cognitive score	8672	64.70	6.16	8288	78.72	4.91
WAI score	9077	64.70	8.33			
Non-cognitive score	9189	-0.00	1.00	8252	-0.00	1.00
Average postcode cognitive score	7388	0.00	1.00	5859	-0.00	1.00
Average postcode non-cognitive score	7887	0.00	1.00	5837	-0.00	1.00
School contacted about behavior				8304	0.11	0.31

A.2 Measures of background variables

Table A.2: Background variables by children's age

	Ages 4-5			Ages 6-7			Ages 8-9			Ages 10-11		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
Share of Kindergarten cohort	9370	0.47	0.50	8704	0.49	0.50	8417	0.49	0.50	7928	0.47	0.50
Female child	9370	0.49	0.50	8704	0.49	0.50	8417	0.49	0.50	7928	0.49	0.50
Age in months	9370	57.25	2.77	8704	81.91	3.23	8417	106.10	3.35	7928	130.21	3.79
Index of SES	9333	0.00	1.00	8654	-0.00	1.00	8349	0.00	1.00	7841	-0.00	1.00
Mother depression	7914	-0.00	1.00	8435	-0.00	1.00	7733	0.00	1.00	7759	0.00	1.00
Index: mothers' interaction with school				3631	0.00	1.00	6964	0.00	1.00	2954	0.00	1.00

A.3 Neighbourhood characteristics

This section provides an additional summary of variables used throughout the analysis. Table A.3 summarizes the neighbourhood characteristics computed by the LSAC. They are based on the statistics from the Census and matched to the data based on the household location. The Index of Neighbourhood Relative Advantage and Disadvantage is computed by the Australian Bureau of Statistics and represents a weighted average of multiple characteristics related to income, employment, education and housing (see Statistics, 2011 for the details of construction). I normalize it by the age group. I additionally control for the age composition of the population and characteristics related to the ethnic or language composition of the population since these variables were not included in the index construction, but can be related to the availability of child development services and language development in the neighbourhood.

Table A.3: Summary of neighbourhood characteristics based on the Census

	Ages 4-5			Ages 6-7			Ages 8-9			Ages 10-11		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
Share population age 0-4	9370	6.68	1.37	8702	6.54	1.30	8416	5.50	1.67	7927	5.53	1.70
Share population age 5-9	9370	7.12	1.53	8702	6.87	1.37	8416	4.18	3.18	7927	4.34	3.24
Index of Neighbourhood Relative Advantage and Disadvantage	9370	0.01	1.00	8702	0.00	1.00	8409	0.00	1.00	7927	0.00	1.00
Share population Aboriginal	9370	2.20	3.99	8702	2.45	5.12	8416	2.33	5.07	7927	2.28	5.06
Share population English - first language	9370	87.03	13.05	8702	86.48	13.83	8416	83.93	15.03	7927	84.27	14.61
Share population born in Australia	9370	86.87	12.41	8702	91.65	8.21	8416	86.57	14.04	7927	84.88	13.00
New South Welsh	9370	0.31	0.46	8704	0.31	0.46	8416	0.31	0.46	7928	0.30	0.46
Victoria	9370	0.25	0.43	8704	0.24	0.43	8416	0.24	0.43	7928	0.24	0.43
Queensland	9370	0.21	0.41	8704	0.21	0.41	8416	0.22	0.41	7928	0.22	0.41
South Australia	9370	0.07	0.25	8704	0.07	0.25	8416	0.07	0.25	7928	0.07	0.25
Western Australia	9370	0.10	0.30	8704	0.10	0.30	8416	0.10	0.30	7928	0.10	0.31
Tasmania	9370	0.03	0.16	8704	0.03	0.17	8416	0.03	0.16	7928	0.03	0.17
Northern Territories	9370	0.01	0.12	8704	0.01	0.12	8416	0.01	0.11	7928	0.01	0.11
Australian Capital Territory	9370	0.02	0.15	8704	0.02	0.15	8416	0.02	0.16	7928	0.03	0.16

A.4 School and family investments

Table A.4 describes the therapy uptake by children ages 4-5 and 6-7. The uptake of non-cognitive therapy increases with age, while the uptake of cognitive therapy decreases as children begin formal schooling at 6-7.

Table A.4: Summary of school investment measures

	Ages 4-5			Ages 6-7		
	N	Mean	SD	N	Mean	SD
Child behav. therapy or psych. assessment	9002	0.04	0.21	8243	0.06	0.24
Child speech or learning therapy	9002	0.14	0.35	8243	0.12	0.33

Table A.5 summarizes the family investment measured when children are ages 8-9 and 10-11. Measures of family investment used in the analysis describe parenting, uptake of community parenting resources and professional services, household members' weekly activities with children, the total time mothers and fathers spend with children, and mothers' expectations about children's future educational attainment.

Measures of the uptake of community resources include the use of parenting education resources and support groups. Mothers are asked whether anyone in the family has used parenting education courses or programs within the last 12 months. They are also asked whether anyone in the family has used parental support groups or parent helpline within the last 12 months. Around 4 percent of mothers report the use of community resources when children are 8-9 and 10-11.

The measures of mothers' parenting include warmth and anger or hostility dimensions. Both measures use the scores constructed by LSAC. The maternal warmth score represents the average for a battery of questions self-reported by mothers measuring the extent to which mothers display warm, affectionate behaviour towards the child. Similarly, the maternal anger score represents the average for a battery of questions measuring the extent to which maternal interactions with children involve disapproval, anger, and the lack of praise. The parenting measures are age-standardized.

The measure of the frequency of additional help or tutoring allows mothers' to choose between several categories, including no additional help or tutoring, less than once a week, once a week, and more than once a week. I set the weekly number of tutoring sessions to zero if mothers report no tutoring, to 0.5 if mothers report that children meet with a tutor less than once a week, to 1 if mothers report that children have weekly tutoring sessions, and to 1.5 if mothers report that children meet with a tutor more than once a week. On average, children have 0.16 weekly tutoring sessions when they are 8-9 years old.

Mothers' educational aspirations for their children are recovered from the question ”Looking ahead, how far do you think study child will go in his/her education?”. I create a binary variable equal to one if mothers expect that their child will obtain a university degree or post-graduate qualifications at a university. Almost 70 percent of mothers expect their children to obtain a college degree.

Several variables summarize the frequency with which members of the household engage in educational activities with the child. Mothers are asked to report whether members of the household have engaged in several activities with the child over the past week, including reading. I transform categorical answers to the weekly frequency as follows: zero if mothers choose ”Not in the past week”, 1.5 times for ”1 or 2 days”, 4 times for ”3-5 days”, and 6.5 times for ”6-7 days”. On average, household members read to their children 2.18 times per week. Mothers reported spending, on average, 26 hours per week actively doing things with their children, while fathers reported spending only 12 hours[44].

[44]The exact question asked mothers and fathers ”How much time per week do you spend actively doing things with your children, (for example, playing with them, helping them with personal care, teaching, coaching or actively supervising them, getting them to childcare, school or other activities?”

Table A.5: Summary of family investment measures

	Ages 8-9			Ages 10-11		
	N	Mean	SD	N	Mean	SD
Used parenting education courses or programs last 12 months	8380	0.04	0.20	7857	0.04	0.20
Used parent support groups or info from phone/net last 12 months	8380	0.04	0.20	7857	0.04	0.19
Additional help or tutor times per week	4058	0.16	0.41	7653	0.17	0.41
Mother warmth score	7688	-0.00	1.00	7635	0.00	1.00
Mother anger score	7684	-0.00	1.00	7635	-0.00	1.00
Mother expects child coll+	8095	0.67	0.47	3560	0.67	0.47
Weekly times talk school	8369	6.70	0.94	7869	6.70	0.93
Weekly times read	8378	2.18	2.33	4160	1.11	1.84
Mother average weekly time with child	8215	26.17	17.69	3637	21.81	15.32
Father average weekly time with child	5170	11.97	9.77	2334	11.39	9.46

A.5 Additional controls

Table A.6 describes additional controls used in Columns (3) and (4) or Table 2 to account for potential idiosyncratic shocks to children's development measures when children are 4-5 years old. The sleeping problems score uses age-standardized answers of mothers to the question about the frequency with which children had problems sleeping over the past month evaluated using the Likert scale.

The ages of the oldest and the youngest children in the children's group are retrieved from the teachers' questionnaire. On average, the youngest child was 50 months old and the oldest child was almost 67 months old.

During the PPVT test, the majority or parents remained at a distance from their children or observed them. Around 10 percent of parents have actively encouraged their children. Similarly, the majority of children have performed the test with other children not present in the room or remaining at a distance.

Table A.6: Additional control measures

	Ages 4-5		
	N	Mean	SD
Sibling not present	4329	0.62	0.49
Parent not present	4329	0.12	0.32
Interview December	9370	0.00	0.04
Sleeping problems score	8005	0.00	1.00
Parent at a distance	4329	0.42	0.49
Parent observed	4329	0.35	0.48
Parent encouraged	4329	0.10	0.30
Parent interfered	4329	0.01	0.12
Sibling at a distance	4329	0.22	0.41
Sibling observed	4329	0.14	0.35
Sibling encouraged	4329	0.01	0.11
Sibling interfered	4329	0.01	0.09
Interview January	9370	0.00	0.04
Interview February	9370	0.00	0.01
Interview March	9370	0.06	0.23
Interview April	9370	0.12	0.33
Interview May	9370	0.19	0.39
Interview June	9370	0.17	0.38
Interview July	9370	0.20	0.40
Interview August	9370	0.16	0.37
Interview September	9370	0.06	0.24
Interview October	9370	0.02	0.15
Interview November	9370	0.01	0.11

A.6 Teachers' characteristics

Table A.7 summarizes teacher's characteristics when children are ages 4-5. 64 percent of teachers have a college degree in education. About 48 percent of teachers have a bachelor's degree and 15 percent have a postgraduate degree in education. When children are ages 4-5, . The average teaching experience is 15.6 years. The majority of teachers have teaching experience exceeding 10 years. Only 16 percent of teachers have 5 or less years of experience.

Table A.7: Teachers' characteristics for children ages 4-5

	Ages 4-5		
	N	Mean	SD
Child attends daycare	8907	0.26	0.44
Teacher coll+ in Educ.	6336	0.64	0.48
Teaching experience 0-5 years	6337	0.16	0.37
Teaching experience 6-10 years	6337	0.22	0.41
Age of youngest child in class	6196	47.49	10.08
Age of oldest child in class	6189	64.67	8.74
Children to qualified staff ratio	6523	14.46	7.02

Table A.8 analyzes the strength of the potential selection of better-quality teachers and programs in more developed neighbourhoods. I estimate a set of linear probability models, where dependent variables include various teacher and program characteristics described above, and independent variables include average neighbourhood levels of non-cognitive and cognitive development, child's age in months, gender, and cohort, household SES index, and neighbourhood characteristics and Australian territory.

The evidence suggests that the selection of more qualified early childhood instructors in more developed neighbourhoods is limited. Instructor's education and experience do not depend on the average level of development in the neighbourhood in a statistically significant way. Children from neighbourhoods with higher average cognitive scores are less likely to attend daycare versus kindergarten or preschool. Since the type of arrangement was not a prominent factor in the delay recognition based on the results discussed in Section 4.1, this selection is unlikely to drive the estimated role of the reference group.[45]

[45]Estimating the role of reference group separately for subsamples of children who attend daycare vs kindergarten

or preschool confirms the role of the average neighbourhood non-cognitive development for teachers' perceptions about non-cognitive delays in both subsamples.

Table A.8: Selection of teachers in more developed neighbourhoods

	Coll. in Educ.	Daycare	Teach. exper. 0-5 years	Teach. exper. 6-10 years	Age youngest	Age oldest	Child/staff ratio
Neighbourhood cognitive score	-0.013	-0.026*	-0.012	-0.014	0.415	0.252	-0.291
	(0.013)	(0.008)	(0.008)	(0.009)	(0.225)	(0.229)	(0.156)
Neighbourhood non-cognitive score	0.005	0.001	-0.001	0.005	-0.358	0.115	0.071
	(0.010)	(0.007)	(0.007)	(0.008)	(0.185)	(0.128)	(0.125)
N	5033	7004	5047	5047	4926	4918	5199

A.7 Childcare arrangement

Table A.9 summarizes childcare arrangements when children are ages 4-5. The majority of children attend preschool or kindergarten, and 26 percent of children attend daycare. Only a few kids in the sample go to school at this stage.

Table A.9: Childcare arrangements for children ages 4-5

	Ages 4-5		
	N	Mean	SD
Child attends Grade 1	8895	0.00	0.02
Child attends daycare	8907	0.26	0.44
Child attends preschool or kindergarten	8907	0.74	0.44

B Measured development and later outcomes

I test whether interview measures of a children's non-cognitive and cognitive development are significant predictors of child outcomes in the later periods. Better child non-cognitive scores at ages 4-5 is associated with a lower probability of repeating the grade by ages 12-13 and higher scores for the nationwide tests of Grade 9 reading and numeracy.

Table B.10: Interview development measures at age 4-5 and later child outcomes.

	Repeated grade by ages 12-13	Grade 9 Reading	Grade 9 Math
Non-cognitive score	-0.010*	4.199*	4.440*
	(0.003)	(0.873)	(0.929)
Cognitive score score	-0.011*	17.490*	12.168*
	(0.003)	(0.869)	(0.920)
N	6699	5739	5678

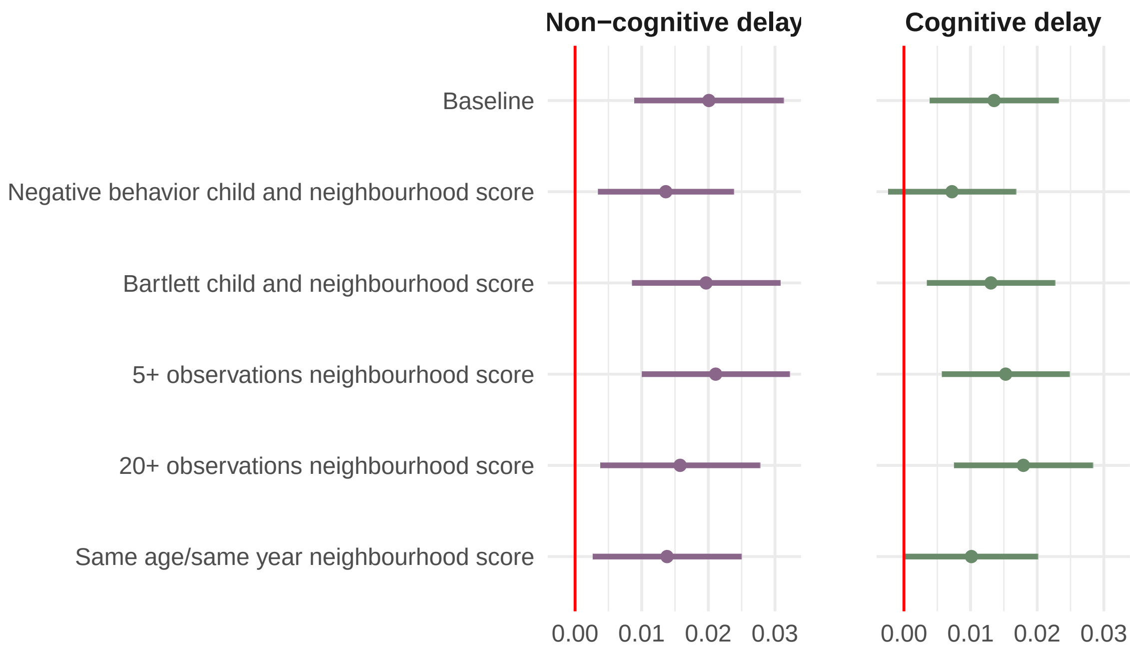
Notes: Linear regressions. Control: children's gender, cohort, and age in months, household socioeconomic status (SES) index. SE clustered at the postcode level.

C Robustness to the construction of average neighbourhood development

This section explores the sensitivity of estimates reported in columns (2) and (4) of Table 1 to the choice of method for constructing non-cognitive skill scores and average neighbourhood child development scores. Figure C.1 shows the estimated effect of the average neighbourhood non-cognitive development level ($\beta^{T,N}$) on teacher's perceptions about non-cognitive and cognitive delays (see Equation (6)). Across specifications, the non-cognitive score or the average neighbourhood non-cognitive score are constructed in varying ways.

- "Baseline" estimates correspond to the estimates reported in Columns (2) and (4) in Table 1.
- "Negative child and neighbourhood score" specification uses only the degree of negative response during the interview as a measure of non-cognitive skills. Compared to the baseline measure of non-cognitive skill, this score does not account for the child's focus during the cognitive test and the degree of positive behaviour. The average neighbourhood non-cognitive development levels are then computed using the approach described in Subsection 2.4.
- "Bartlett child and neighbourhood score" uses the Bartlett factor score from 3 interview measures of non-cognitive skills as a measure of non-cognitive skills. The average neighbourhood non-cognitive development levels are then computed using the approach described in Subsection 2.4.
- "5+ observations neighbourhood score" specification uses the baseline individual score of non-cognitive development but computes the average neighbourhood level of development when at least 5 measures of non-cognitive skills for children other than the study child are available in the neighbourhood across both cohorts of children. This is a lower requirement for the data compared to the baseline requirement of 10+ observations.
- "15+ observations neighbourhood score" uses the baseline individual score of non-cognitive development, but computes the average neighbourhood level of development when at least

Figure C.1: Estimated coefficient of the average neighbourhood non-cognitive development



15 observations are available in the neighbourhood. This is a more demanding requirement for the data compared to the baseline requirement of 10+ observations.

- "Same age/same year neighbourhood score" uses the baseline individual score of non-cognitive development, but computes the average neighbourhood development only for the children from the same cohort (same age/same year) if more than 5 measures are available in a given postcode. By contrast, the baseline specification uses de-meaned measures of children from both cohorts (same age/different years).

Estimates remain consistent across these different specifications. Using only the degree of negative response to measure children's cognitive skills reduces the estimated role of average neighbourhood non-cognitive development for perceptions about cognitive delays, but not in a statistically significant way compared to the baseline estimates.

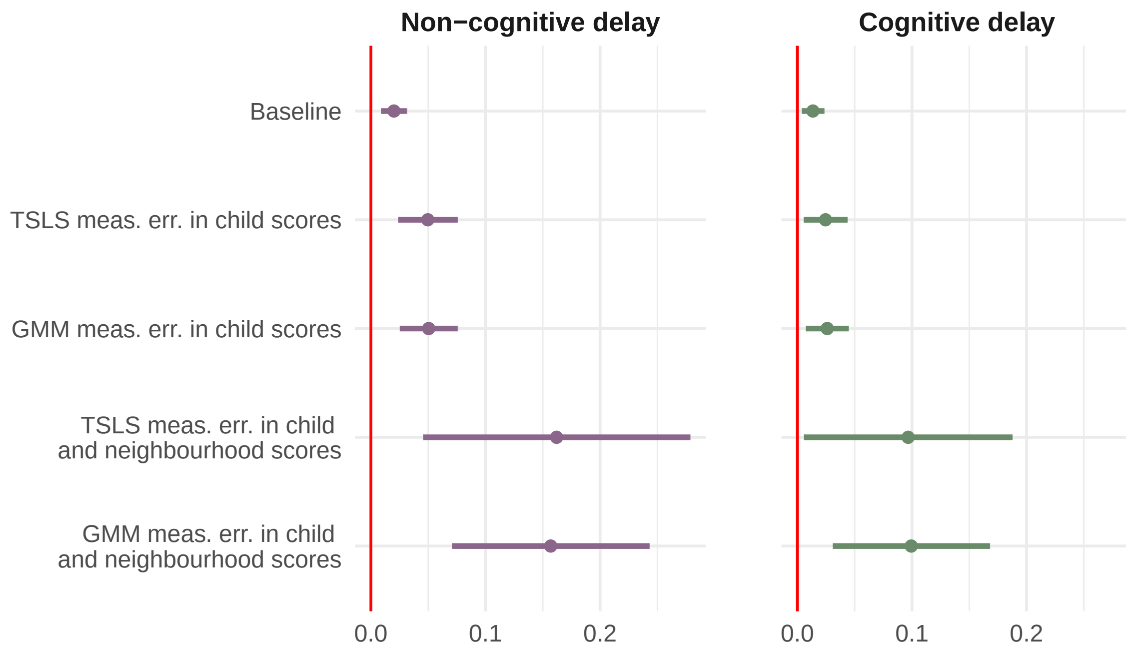
D Robustness to the measurement error

This section explores the sensitivity of the estimates to adjusting for the measurement error in the neighbourhood average child development measure in addition to the child's own development score. Adjusting for the measurement error makes the estimated effect of the average neighbourhood non-cognitive development larger in magnitude and noisier.

Figure D.1 shows the estimated $\beta^{T,N}$ for the specification in Equation (6).

- "Baseline" estimates correspond to the estimates reported in Columns (2) and (4) in Table 1.
- "TSLS meas. err. in child scores" correspond to estimates reported in columns (3) and (6) of Table 2. Here, I adjust for the measurement error in the child's own development measures by instrumenting for the child's PPVT score with the WAI score and instrumenting for the child's focus during the cognitive test with the degrees of negative and positive responses.
- "GMM meas. err. in child scores" adjusts for measurement error in the child's own scores and uses GMM estimation of perception equations for both cognitive and non-cognitive delays. This allows errors to be correlated across equations.
- "TSLS meas. err. in child and neighbourhood score" adjusts for the potential measurement error in children's own scores and in average neighbourhood development scores. Here the average neighbourhood PPVT score is instrumented with the average neighbourhood WAI score, and the average neighbourhood focus during the cognitive test is instrumented with the average degrees of negative and positive response.
- "GMM meas. err. in child and neighbourhood score" adjusts for the measurement error in children's own scores and in average neighbourhood development scores using GMM estimation of perception equations for both cognitive and non-cognitive delays, which allows errors to be correlated across equations.

Figure D.1: Estimated coefficient of the average neighbourhood non-cognitive development



E Sensitivity to the selected measure of teachers' perceptions

This section estimates the reference bias in teachers' perceptions about children's non-cognitive skills using an alternative measure of teacher's perceptions. I construct a continuous measure of teachers' assessment of children's non-cognitive problems based on a selection of subquestions from the Strength and Difficulty Questionnaire. The Strength and Difficulty Questionnaire is a battery of questions commonly used to evaluate children's non-cognitive development (Fiorini and Keane, 2014, Nicoletti and Tonei, 2020). I select subquestions that relate to behaviours that were evaluated during the interview.

Table E.1 illustrates the results of the regression specified in (6) where the dependent variable is the constructed index of children's non-cognitive problems for children ages 4-5 and 8-9. The coefficient of the average postcode non-cognitive development is significant and positive and does not decrease with children's age.

Table E.1: Reference bias in alternative measures of teachers' perception about noncognitive skills

	Ages 4-5	Ages 8-9
	(1)	(2)
Neighbourhood cognitive	-0.005	0.002
score	(0.017)	(0.020)
Cognitive score score	-0.076*	-0.051*
	(0.015)	(0.014)
Neighbourhood	0.036*	0.037*
non-cognitive score	(0.017)	(0.017)
Non-cognitive score	-0.070*	-0.054*
	(0.016)	(0.016)
N	5055	4679

Notes: Linear regression. Control: children's gender, cohort, and age in months, household socioeconomic status (SES) index. Standard errors are clustered at the postcode level. Significance level: * 5%.

F Heterogeneity of environment response by mother's education

This section analyzes the heterogeneity of the investment response to perceptions described in Sections 6 and Sections 7 across households with more and less educated mothers. Families from lower SES groups may have different resource constraints. Similarly, their children may attend early childhood education institutions where additional support resources like counsellors and therapists are more scarce.

I estimate linear value-added regressions described in Equations (4) and (5) for subsamples of children ages 6-7 and 10-11 with more- and less-educated mothers. Dependent variables are measures of home and school environment when children are 6-7 and 10-11 years old. The independent variables for specifications related to school investment include lagged measures of teachers' and mothers' perceptions measured at the previous wave of the survey two years ago (ages 4-5 and 8-9 respectively). Similarly, the independent variable for specifications related to home environment includes lagged measure of mothers' perceptions measured at the previous wave of the survey two years ago (ages 4-5 and 8-9 respectively).

Instead of controlling for the SES status index, I split the sample into subsamples based on whether the mother has a college degree, and I include controls for the mother's age, number of siblings, family income, mother's marital status, whether English is the household language, and mothers' employment status. All regressions additionally control for neighbourhood characteristics, Australian territory, lags of the dependent variable and children's cognitive and non-cognitive scores. Specifications analyzing the response of the home environment also account for the mother's depression score.

Table F.1 shows that teachers' and mothers' perceptions about non-cognitive delays are the key determinants of non-cognitive therapy uptake for children from more- and less-educated households. Cognitive delays perceived by teachers are statistically significant predictors of the cognitive therapy uptake for children from less-educated households, but not from more-educated households. However, the difference between the estimated coefficients is not statistically significant. Concerns of mothers about cognitive delays are a stronger predictor of therapy

Table F.1: Delay recognition by teachers and mothers and child therapy, by neighbourhood SES

	Non-cogn. therapy at 6-7		Cogn. therapy at 6-7	
	(1)	(2)	(3)	(4)
	No coll.	Coll+	No coll.	Coll+
Teach.: Non-cognitive delay at 4-5	0.032*	0.058*	0.028	0.018
	(0.016)	(0.021)	(0.021)	(0.025)
Teach.: Cognitive delay at 4-5	0.025	-0.016	0.065*	0.047
	(0.019)	(0.029)	(0.026)	(0.037)
Moth.: Non-cognitive delay at 4-5	0.142*	0.141*	0.088*	0.051
	(0.037)	(0.043)	(0.040)	(0.036)
Moth.: Concern cognitive delay at 4-5	-0.008	0.076	0.013	0.161*
	(0.021)	(0.045)	(0.030)	(0.051)
Therapy non-cogn. at 4-5	0.169*	0.058		
	(0.048)	(0.049)		
Therapy cogn. at 4-5			0.214*	0.279*
			(0.025)	(0.036)
N	2405	1490	2405	1490
R2	0.09	0.09	0.16	0.19
Mean	0.05	0.05	0.12	0.10

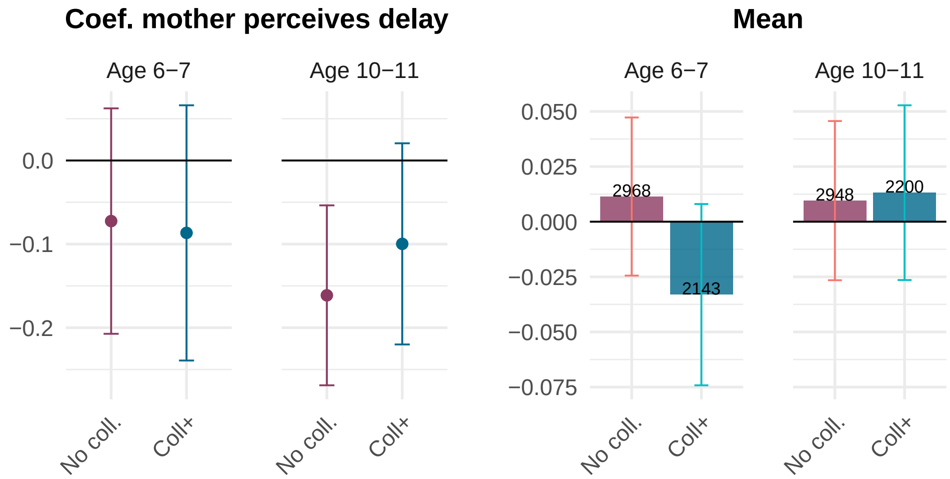
Notes: Linear regression estimated in subsamples by mothers' education. Control: lag dependent variable, lag cognitive and non-cognitive score, children's gender, cohort, age in months, mother's age, number of siblings, family income, mother's marital status, whether English is the household language, and mothers' employment status, neighbourhood characteristics from Census, Australian territory. Standard errors are clustered at the postcode level. Significance level: * 5%.

uptake if mothers have a college degree.

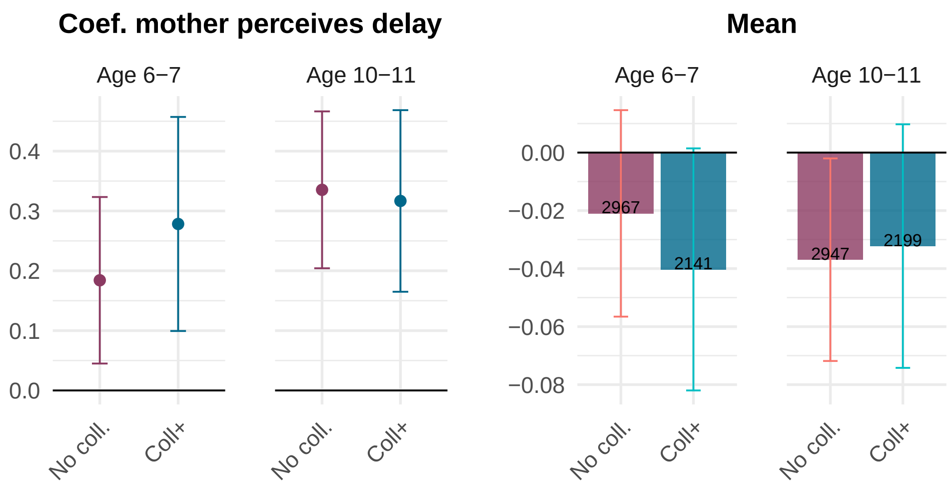
Figures F.1 and F.2 plot the estimated coefficients in front of the lag of perceived non-cognitive delays by mothers in Equation (5) along with the means of the corresponding dependent variables (home environment measures) for the estimation subsamples. There are mainly no statistically significant differences across more- and less-educated households in the magnitudes of responses of home environment to perceived non-cognitive delays. This lack of significant differences can be driven by the decreased power of the test. The decrease in the expected likelihood that children will complete college degrees in response to perceived delays is only significant for more educated mothers. This might be driven by a substantially higher share of college-educated mothers expecting that their children will complete a university degree.

Figure F.1: Parental interactions and attitudes: estimated effect of perceptions and summary

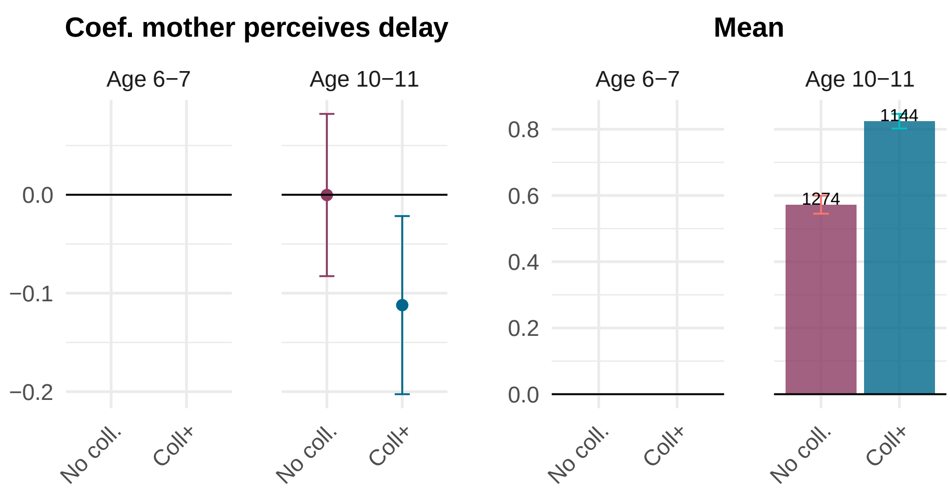
(a) Mother warmth (SD)



(b) Mother anger (SD)



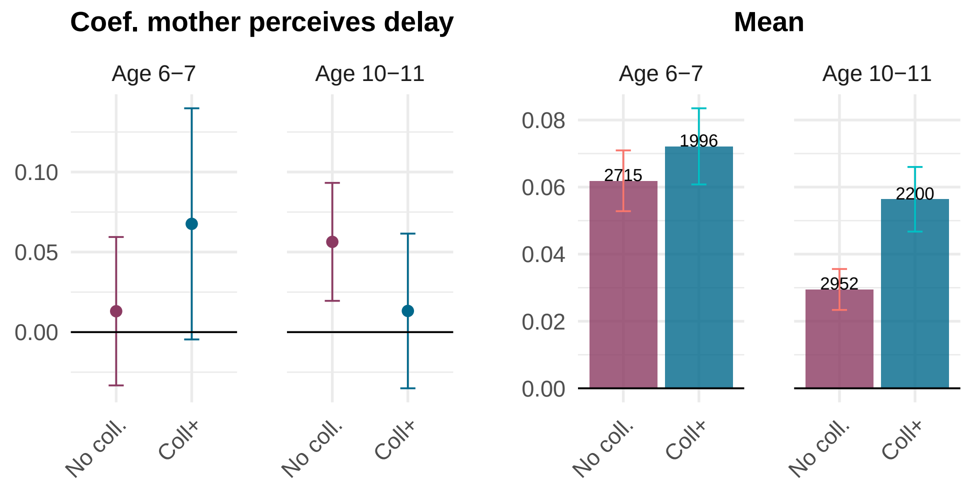
(c) Mother expects to complete coll+



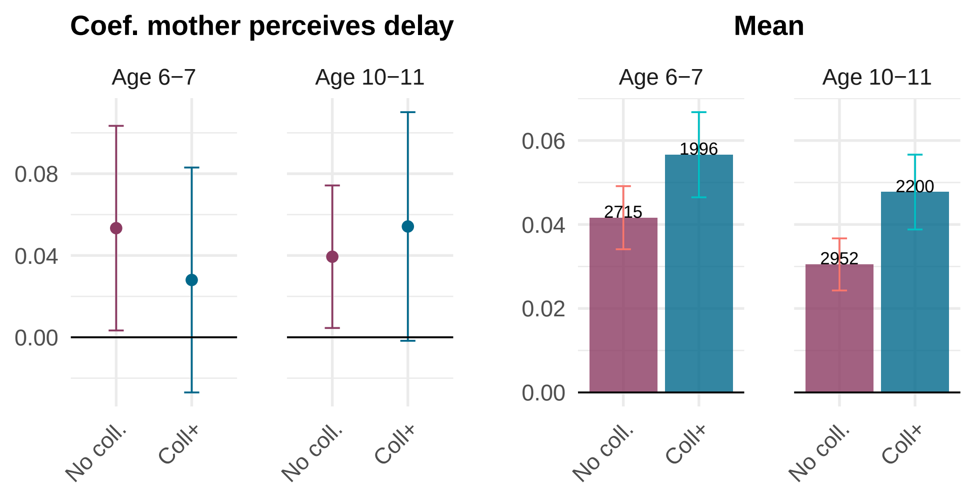
Notes: Right panels plot coefficients from linear regression estimated in subsamples by mother's education. Left panels plot means of dependent variable in the estimation sample. Dependent variable: measure of home environment. Independent variable: lag of mother perceptions about non-cognitive delays. Control: lag dependent variable, lag cognitive and non-cognitive score, children's gender, cohort, age in months, mother's age, number of siblings, family income, mother's marital status, whether English is the household language, and mothers' employment status, mother's depression score, neighbourhood characteristics from Census, Australian territory. Standard errors are clustered at the postcode level.

Figure F.2: Parental use of professional help: estimated effect of perceptions and summary

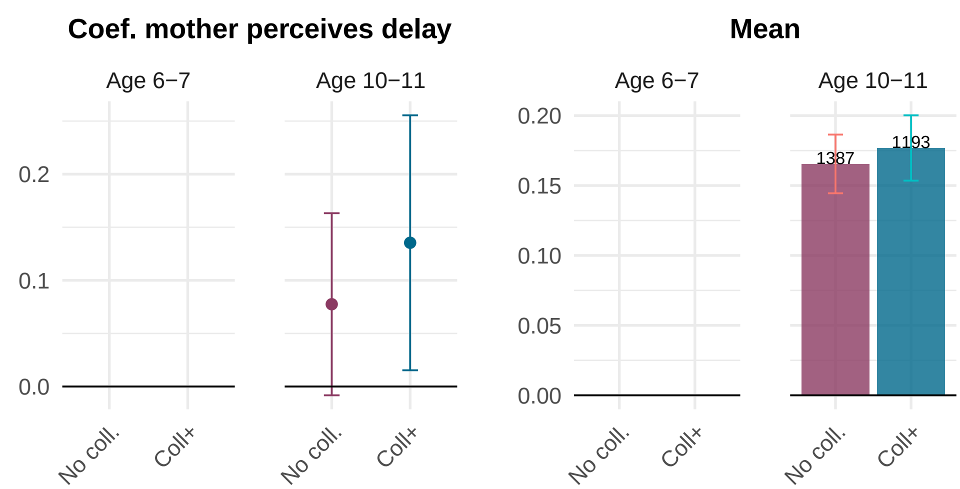
(a) Family used parenting education courses last 12 months



(b) Family used parental support groups or helplines last 12 months



(c) Number of weekly times child used additional help or tutoring last 12 months



Notes: Right panels plot coefficients from linear regression estimated in subsamples by mother's education. Left panels plot means of dependent variable in the estimation sample. Dependent variable: measure of home environment. Independent variable: lag of mother perceptions about non-cognitive delays. Control: lag dependent variable, lag cognitive and non-cognitive score, children's gender, cohort, age in months, mother's age, number of siblings, family income, mother's marital status, whether English is the household language, mothers' employment status, mother's depression score, neighbourhood characteristics from Census, Australian territory. Standard errors are clustered at the postcode level.

G Heterogeneity in mother's belief updating by children's development

This section explores whether mothers respond differently to being contacted by the school about a child's behaviour depending on the objective levels of child development. I split the sample into subsamples based on objective measures of children's non-cognitive development measured when children are ages 8-9. Children with low (high) measured development have a score within the bottom (top) quartile for the distribution of non-cognitive scores in the sample of similar-aged children.

Table G.1 presents the estimates of Equation (7) for subsamples of children with high/low measured development including the same estimation procedure and controls as described in Section 5. Mothers of children with high- and low-measured development are more likely to perceive that their children have non-cognitive delays after being contacted by schools. However, the degree of response in mother's perceptions is larger for children with low-measured development.

Table G.1: Mother's belief updating after being contacted by school for children with high/low non-cognitive development

	Non-cognitive delay perceived by mother at 8-9	
	Low non-cog. at 8-9	High non-cog. at 8-9
School contacted about	0.16*	0.06*
behavior	(0.03)	(0.03)
Mother depression	0.03*	0.01
	(0.01)	(0.01)
Non-cognitive score	-0.01	0.02
	(0.01)	(0.03)
Cognitive score	-0.02*	0.00
	(0.01)	(0.01)
N	1403	1270

Notes: Linear regression estimated in subsamples for children with low/high non-cognitive development. Notes: Linear probability regression. Control: children's gender, cohort, and age in months, household socioeconomic status (SES) index, mothers' depression score, lag mother's perceptions. Standard errors are clustered at the postcode level. Significance level: * 5%