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## **The genetic and environmental etiology of child maltreatment in a parent-based extended family design**

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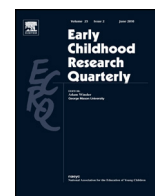
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# Preschoolers' problem behavior, prosocial behavior, and language ability in a Latin-American context: The roles of child executive functions and socialization environments<sup>☆</sup>

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## ABSTRACT

Child executive functions and socialization environments are crucial for the socioemotional and cognitive development of preschoolers. This study examined the role of socioeconomic status (SES), ethnicity, executive functions (EFs), quality of the home environment, quantity of maternal care, and quality and quantity of professional childcare as predictors of five-year-old preschoolers' problem behavior, prosocial behavior, and language ability in 77 low-SES families with a Chilean majority or Mapuche minority background in Chile. Executive functions and the quality of the home environment were positively associated with language ability, whereas quantity of childcare was inversely related to children's language ability. All other associations were non-significant. The results corroborate the vital roles of child executive functioning and stimulating and responsive parenting in child language ability in a Latin-American context. Furthermore, our findings revealed inadequate preschool classroom quality and provide new evidence from southern Chile of the urgent need to improve the quality of Chilean children's preprimary education as a catalyst for reducing social disparities.

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## 1. Introduction

Children typically reach important developmental milestones by preschool age in the socioemotional and cognitive domains. Preschoolers demonstrate substantial advances in their emotion regulation, prosocial behavior, and language acquisition, which contribute to future school achievement and life success (Smith, 2001). It has been estimated, however, that over 200 million children in developing countries do not reach their developmental potential in the first five years of life due to multiple-risk conditions associated with poverty (Grantham-McGregor et al., 2007). There

appears to be consensus in the international literature that delays in cognitive and socioemotional development appear early in life (Contreras & González, 2015; Hoff, 2013) and that the window of opportunity to reduce the gaps is narrow but effective (Vegas & Santibanez, 2010).

Latin America is the world's most unequal region in terms of income distribution, which inevitably carries in its wake unequal early childhood development and educational achievement (Vegas & Santibanez, 2010). The majority of Latin American children grow up in conditions of social vulnerability, and early childhood development policies may be the most powerful tool to equalize opportunities and break the cycle of poverty (Vegas & Santibanez, 2010). A review of home interventions in developing countries revealed that improving young children's cognitive stimulation and learning opportunities has a significant impact on their cognitive functioning (Walker et al., 2007) and first promising results from Latin American early childhood care and education (ECCE) programs and intervention programs show significant increases in children's cognitive and socioemotional development (Behrman, Cheng, & Todd, 2004; Bernal & Fernández, 2013; Lipina & Segretin, 2015; Schady, 2006).

The importance of early childhood development in developing countries cannot be overemphasized, yet despite the urgency

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of the situation we still know little about Latin American socialization environments and their impact on child development. It is worrisome that these relations have so far primarily been researched in developed countries, considering the evidence that associations between specific caregiving dimensions and child development may vary depending on cultural and socioeconomic factors (Bornstein, Putnick, Lansford, Deater-Deckard, & Bradley, 2015; Bradley & Corwyn, 2005; Halgunseth, Ispa, & Rudy, 2006). The current study addresses this research gap and seeks to identify pathways for early childhood intervention by examining whether predictors at multiple levels (child, family, childcare, culture, and SES) affect preschool children's socioemotional adjustment and cognitive development in a bi-ethnic (indigenous Mapuche or Chilean), low-SES sample in the Latin-American context of Chile.

### 1.1. The Chilean context

Chile is of particular interest in the context of poverty and child development, as three out of ten Chilean children live below the poverty line according to UNICEF (Hudson & Kühner, 2016), and the country has one of the highest levels of economic inequality in the world (World Bank, 2019). Seventy-one percent of the adult population has no post-secondary schooling (CASEN, 2013a), and 81% of the working and tax-paying population earns an average of US\$ 338 per capita per month (López, Figueroa, & Gutiérrez, 2013). To fully understand the magnitude of these figures, it is important to note that in 2017 the minimum wage was US\$ 400 (264,000 CLP) as determined by the Chilean Ministry of Labor (2017).

Chile is a multi-ethnic society, home to native Americans and descendants of European immigrants. The indigenous Mapuche people are the largest ethnic minority group in Chile and account for 9% of the national population. Colonial conquest and subsequent military campaigns by the Chilean State led to severe territory reductions. Consequently, the Mapuche had to retreat to the southern regions of Chile, which nowadays constitute the stronghold of Mapuche culture. The largest regional Mapuche population (31.3%) and the country's highest regional poverty rate (28%) are both found in the Araucanía region (CASEN, 2013a; INE, 2012). The vast majority of Mapuche have undergone processes of urbanization and acculturation to Chilean culture and are thus largely indistinguishable from Chilean majority group members of the same social class (Caniguan, 2012). Nevertheless, there are indications that poverty rates are higher amongst Mapuche minority group members than Chilean majority group members (Cerdeña, 2009).

According to a recent national survey (CASEN, 2015), the childcare enrollment rate of Chilean preschoolers aged between 4 and 5 years is 90%. Children attend childcare from Monday to Friday for at least 4 h per day. In the absence of government regulations, preschools are free to determine their own schedules: many offer 6–8 h a day, and extended schedules are available for working parents. The Chilean Ministry of Education developed curricular guidelines for preschool education, which cover three important developmental domains of the child: (1) personal and social development, (2) communication, and (3) relation to the natural and cultural environment (MINEDUC, 2008). Children make the transition to primary education at the age of 6 or 7. In this context, it is noteworthy that in Chile 37.5% of schools are public, 48% are government-dependent private schools, and 14.5% are independent private schools (OECD, 2014).

### 1.2. Social relevance

The Government of Chile has identified early childhood development policy as a key priority in its efforts to reduce economic inequality. In 2007, Chile launched its flagship *Chile Grows with You* (*Chile Crece Contigo*) to assist socially vulnerable families.

This ECCE program is funded by the World Bank and consists of a set of policies guaranteeing that children from the poorest 60% of households have access to free healthcare and education from the prenatal stage until they enter primary school (Peralta, 2011). An impact evaluation study investigated the efficiency of this program in a large nationally representative sample (Bedregal, 2010, 2013). Results indicate that 32% of the no-treatment controls (1705 children aged 30–53 months) and 34% of the treatment group (1429 children, aged 30–48 months) showed developmental delays, mainly in the areas of socioemotional (34.1% of the affected no-treatment controls and 22.1% of the affected treatment group) and language development (36.5% of the affected no-treatment controls and 45.6% of the affected treatment group). Thus, according to this study, the *Chile Grows with You* program does not seem to produce the desired outcomes and it can be concluded that already at this young age, one in three Chilean children is ill-prepared to succeed in school.

These gaps persist or increase over time as the children advance in the school system. Disadvantaged children in Chile are hence in a double-risk situation, as both their home and childcare/(pre)school environments are of insufficient quality to guarantee an adequate developmental trajectory. Access to good quality education, however, is reserved for a small percentage of affluent and privileged families (OECD, 2015). Consequently, 45% of Chilean students are unable to attain basic skills (as reflected in the exams of the Program for International Student Assessment, PISA) that are considered minimum prerequisites for participating productively in modern economies (OECD, 2015). The privatized Chilean educational system (63% of schools are private) is the propelling force behind Chile's economic inequality and social segregation, and systematically impedes social mobility (Alarcón, Castro, Frites, & Gajardo, 2015; OECD, 2015). Considering these troubling circumstances, it seems pivotal to identify predictors of salient aspects of child development as candidates for early childhood interventions to address such problems.

### 1.3. Theoretical framework

The current study is embedded in Bronfenbrenner's bioecological framework (2005). This theoretical model provides insights on how child development is determined by the child's biological characteristics, proximal processes (family and childcare), and more distal processes (cultural and economic contexts). At the child level, executive functions (EFs) help children to maintain selective attention, exercise behavioral control, regulate their emotions, and control their cognitive processes. These basic abilities facilitate adaptive child functioning in the socioemotional and cognitive domain (Diamond, 2013). At the socialization level, high quality environments characterized by availability of age appropriate learning materials and responsive caregiving provide children with more linguistic stimulation and more favorable emotion regulation skills (Gosse, McGinty, Mashburn, Hoffman, & Pianta, 2014; Morris, Criss, Silk, & Houlberg, 2017).

As family and childcare are the two most influential socialization agents in early childhood, the quality and quantity of childcare environments at home and in childcare will be examined as predictors of child developmental outcomes. Furthermore, contextual factors such as the family's socioeconomic and cultural background are included as covariates in the study, because they are known to predict different child developmental outcomes (Bornstein et al., 2015; Grantham-McGregor et al., 2007).

### 1.4. Developmental milestones at preschool age

Children's emotion regulation is one of the important milestones in early development and has important implications for

adaptive functioning later in life (Murray & Kochanska, 2002). Deficient emotion regulation manifests itself in children's behavior problems, such as internalizing or externalizing behavior. Children who internalize are emotionally reactive, withdrawn, and are prone to experience feelings of anxiety and depression. In contrast, children who externalize experience more anger, impulsivity, aggression, and attention problems (Achenbach & Rescorla, 2000).

A second milestone in early childhood is the development of prosocial behavior, which allows children to engage in "positive interactions with other people, including helping, sharing, cooperating, and comforting" (Scourfield, John, Martin, & McGuffin, 2004, p. 927).

A third developmental milestone during early childhood is the acquisition of language, which is crucial to children's social, emotional, and academic adjustment (Beitchman & Brownlie, 2005; Forget-Dubois et al., 2009). Children's executive functioning, the quantity and quality of the caregiving environment at home and in childcare, and children's socioeconomic and ethnic background will be discussed as predictors of these three developmental milestones based on Western, Latin American, and Chilean literature.

### 1.5. Executive functions and child development

EFs are directing thought processes that optimize behavior in changing environments and consist of three main abilities: (1) working memory, (2) inhibitory control (attentional, cognitive, and behavioral inhibition), and (3) cognitive flexibility (Diamond, 2013). These abilities are crucial for optimal child development and life success in all domains and are often more predictive than IQ or SES (Alloway & Alloway, 2010; Duckworth & Seligman, 2005; Moffitt et al., 2011). The results of a recent meta-analysis show that impairments of all three EF abilities, but in particular of inhibition, are associated with externalizing problem behavior in the preschool years (Schoemaker, Mulder, Deković, & Matthys, 2013). Deficits in EFs across the preschool period have also been linked to internalizing problem behavior in first grade (Hughes & Ensor, 2011). In preschoolers, EF abilities have moreover been related to prosocial skills, positive relationships in the classroom, and social competence (Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009; Yeates et al., 2007). Furthermore, EFs have been reported to significantly predict vocabulary, listening comprehension, and emergent literacy (McClelland et al., 2007; Nayfeld, Fuccillo, & Greenfield, 2013), and to be significantly associated with verbal ability in Head Start preschoolers (Fuhs & Day, 2011).

Work on EFs as predictors of child development in Latin America is highly limited. One study found that EFs did not predict early literacy and language development in Chilean preschoolers (Barata, 2011). However, EFs deserve special research attention in the Chilean context because the international literature shows that children who lag behind most on EFs (such as children from low-SES homes) benefit most from any EF interventions (Flook et al., 2010; Karbach & Kray, 2009; Lakes & Hoyt, 2004). Evidence from Argentina suggests that training EFs early in life can be an effective way of addressing social disparities in academic attainment by reducing the EF gap in children from low-SES backgrounds before school entry (Lipina & Segretin, 2015).

### 1.6. Home environment and child development

During early childhood, children usually spend most of their time at home with their primary caregivers, and the relation between the quality of home caregiving and child outcomes is well established (NICHD ECCRN, 2004). The richness of children's developmental experiences depends on the physical and psychosocial environments in which they grow up (Caldwell & Bradley, 2003). Western studies have consistently found that the avail-

ability of learning materials and quantity and quality of parental support and stimulation predict favorable child outcomes in several domains (Bradley, Corwyn, McAdoo, & Garcia Coll, 2001; Isenberg & Quisenberry, 2002). Higher quality of the home environment has been linked to fewer behavioral problems (NICHD ECCRN, 2003a; Pachter, Auinger, Palmer, & Weitzman, 2006), higher social competence (NICHD ECCRN, 2003a; NICHD ECCRN, 2004), and more favorable language development (Connor, Son, Hindman, & Morrison, 2005; McClelland, Kessenich, & Morrison, 2003; Morrison & Cooney, 2001; NICHD ECCRN, 2004) in children across the first few years of life.

Relations between quality of the home environment and child development outcomes have received little research attention in Latin American countries so far. We discuss here the few relevant findings. One study indicated that parents in Latin America placed less emphasis on cognitive stimulation and teaching of academic skills than parents in Western countries, and that parental responsiveness in Paraguay and Argentina was lower than in the US, whereas parental responsiveness in Costa Rica and Chile was not much lower (Bradley & Corwyn, 2005). Another study found that higher levels of maternal responsiveness were associated with increased cognitive ability and fewer behavioral problems in preschool children in Chile and Colombia (Walker et al., 2007). Data from a large Ecuadorian sample revealed that language development was significantly higher in children growing up in higher quality homes (Paxson & Schady, 2005). Two Chilean studies reported positive associations between the quality of the home environment and preschoolers' language development (Coddington, Mistry, & Bailey, 2014; Lohndorf, Vermeer, Cárcamo, & Mesman, 2017). Strasser and Lissi (2009) reported that Chilean children were exposed to fewer literacy experiences than children in developed countries, at home and at school.

An often-used proxy for quantity of maternal care is maternal employment status. Recent meta-analyses have shown that maternal employment during the first years of life is generally not associated with behavior problems, social interaction skills, or cognitive outcomes in children in Western contexts (Erel, Oberman, & Yirmiya, 2000; Lucas-Thompson, Goldberg, & Prause, 2010). However, the Canadian National Longitudinal Survey of Children and Youth found that maternal employment was positively related to children's prosocial behavior (Nomaguchi, 2006). This suggests that preschoolers do not suffer from and might even benefit from maternal employment, as it allows them to interact with non-parental adults and peers.

Research from Latin America is scarce. A Mexican study reports that maternal employment did not affect cognitive and linguistic child development (Fernald, Neufeld, & Barton, 2005). Data from the large-scale nationally representative sample of the Longitudinal Survey of Early Childhood in Chile (Encuesta Longitudinal de la Primera Infancia, ELPI) revealed that maternal employment during the first year after birth had no impact on the child's cognitive development, whereas employment in the second year was associated with an increase in receptive vocabulary during preschool age (Contreras & Thiveos, 2014).

### 1.7. Childcare environment and child development

Eighty-four percent of children in OECD (Organization for Economic Cooperation and Development) countries are enrolled in pre-primary education between 3 and 5 years (OECD Family Database, 2013), indicating that the vast majority of preschool aged children spend a considerable part of their young lives in childcare. Childcare experiences inevitably shape child development. The physical infrastructure, availability of books, toys and learning materials, the quality of caregiving and social interactions with peers, and the variety of physically, cognitively, linguistically, and artistically stimulating activities offered to the child can help or



hinder their development (Burchinal, 2018; NICHD ECCRN, 2005). Western findings on the influence of childcare quality on children's developmental outcomes is inconclusive. Several studies demonstrated that higher childcare quality during the first years of life is related to fewer behavior problems and higher social competence (Burchinal, Vandergrift, Pianta, & Mashburn, 2010; Mashburn et al., 2008; NICHD ECCRN, 2001), and to higher expressive and receptive vocabulary (Connor et al., 2005; Howes et al., 2008; Mashburn et al., 2008; NICHD ECCRN, 2004). Other scholars, however, have pointed to evidence showing that the associations between childcare quality indicators and language, social skills, and behavior problems are generally weak (Burchinal, Kainz, & Cai, 2011; Weiland, Ulvestad, Sachs, & Yoshikawa, 2013; Zaslow, Martinez-Beck, Tout, & Halle, 2011).

The scarce evidence available from Latin America suggests that the quality of childcare is low, as studies from Costa Rica (Sánchez Pacheco, Fornaguera Trías, Rodríguez Villagra, & Sibaja Molina, 2017), Ecuador (Araujo, Lopez-Boo, Novella, Schodt, & Tomé, 2015), Peru, Colombia, and Brazil (Berlinski & Schady, 2015) indicate. Concerns have also been raised about process and instructional quality in Chilean early childhood education (Eyzaguirre & Le Foulon, 2001; Herrera & Bellei, 2002; Herrera, Mathiesen, Merino, & Recart, 2005; Strasser & Lissi, 2009); researchers have found minimal or inadequate quality. Furthermore, positive associations between classroom quality and cognitive child outcomes were found in a large Peruvian sample (Araujo, Dormal, & Schady, 2017) and a very large Ecuadorian sample (Araujo, Carneiro, Cruz-Aguayo, & Schady, 2016). The quality of childcare showed a negative relation with problem behaviors and a positive relation with social development, language ability and early writing in Chilean preschoolers (Herrera et al., 2005; Leyva et al., 2015).

The amount of time young children spend in childcare also seems to matter. A large-scale US study found that the more time children spend in nonmaternal care during early childhood the more problem behaviors they exhibit during preschool (NICHD ECCRN, 2001; NICHD ECCRN, 2003b), elementary school (Belsky et al., 2007), and secondary school (Vandell, Belsky, Burchinal, Steinberg, & Vandergrift, 2010). These results, however, were not replicated in a large-scale Norwegian sample in the context of homogeneously high-quality childcare (Zachrisson, Dearing, Lekhal, & Toppelberg, 2013). Large-scale US studies also found that more time spent in nonmaternal care during early childhood predicts less social competence at preschool age (Loeb, Bridges, Bassok, Fuller, & Rumberger, 2007; NICHD ECCRN, 2001; 2003b). The literature on the influence of childcare quantity on children's language learning reveals mixed findings. The Early Child Care Research Network reports no relations between the amount of childcare attendance and language outcomes (NICHD ECCRN, 2000), whereas others find positive relations (Loeb et al., 2007; Luijk et al., 2015). There are also indications that this influence is modulated by family SES. It appears that spending more time in childcare shows more favorable outcomes for children from economically disadvantaged homes than for children from economically more advantaged homes (McClelland et al., 2003; Sameroff & Chandler, 1975). These findings are in line with the compensatory hypothesis stating that favorable childcare environments can compensate to a certain degree for unfavorable home environments (Leseman & Slot, 2014).

Research concerning quantity of childcare is mixed in Latin America. There are indications from Bolivia and Columbia that ECCE programs were positively associated with children's cognitive and socioemotional development (Behrman et al., 2004; Bernal & Fernández, 2013). Attendance at an Argentinian preschool program had significant impacts on language and math performance in third grade (Schady, 2006). By contrast, in Ecuador, exposure to an ECCE program was negatively associated with cognitive and language development (Rosero & Oosterbeek, 2011). In Chile, one

large-scale longitudinal study reports that children spending more hours in childcare during their third year of life exhibited more behavior problems (Narea, 2014), whereas a second study found significant positive effects in the area of emotional regulation (Noboa-Hidalgo & Urzúa, 2012). A third study found no significant relation (Urzúa & Veramendi, 2011). Moreover, one Chilean study reported that childcare attendance was related to negative social competence outcomes (Noboa-Hidalgo & Urzúa, 2012). Furthermore, some studies have found positive relations between the amount of childcare attendance and language outcomes (Cortázar, 2012; Narea, 2014; Noboa-Hidalgo & Urzúa, 2012); by contrast, others report no relations (Bucarey, Ugarte, & Urzúa, 2014; Contreras & González, 2015; Urzúa & Veramendi, 2011).

### 1.8. Socioeconomic status, ethnicity, and child development

The cultural context in Bronfenbrenner's (2005) bioecological model includes SES and ethnicity as distal processes affecting child development in the social, emotional, and cognitive domains. SES refers to an individual's social class and is commonly estimated based on household income, material resources, education, and occupation. Social class determines children's developmental opportunities, school achievement, and success in life (Evans, 2004). Children from low-SES backgrounds are vulnerable to the accumulation of several environmental risk conditions which become an impediment for reaching their potential across different developmental domains (Evans, 2004; Grantham-McGregor et al., 2007). Due to limited developmental opportunities, children from low-SES homes are inclined to demonstrate more problem behaviors, weaker social competences, and less language ability compared to their more affluent peers (Berger, Paxson, & Waldfogel, 2009; Engle & Black, 2008; Huaqing Qi & Kaiser, 2003). Findings from the ELPI study about the impact of social disparities on child development in Chile indicate that SES-related developmental differences emerge during early childhood, and that there is a considerable association between SES and child language development (Contreras & González, 2015) and between SES and child problem behavior (Ulloa, Cova, & Bustos, 2017).

The relations between caregiving processes and child outcomes in early childhood may also differ as a function of culture and ethnicity, because they contribute to shaping a common identity and heritage of group members (Bornstein et al., 2015; Quintana et al., 2006). Children are embedded in their unique sociocultural environment with their own set of traditional values and beliefs, which translate into daily routines, childcare customs, and parenting practices (Super & Harkness, 2002). Furthermore, ethnic minority group members often experience racism, individual or institutional discrimination, marginalization, the stigma of inferiority, and restricted socioeconomic opportunities and mobility (Williams, 1999). Indigenous ethnic minority groups are known to experience additional stressors such as loss of lands, culture, language and identity, and adjustment to the dominant culture and lifestyle (King, Smith, & Gracey, 2009). According to a United Nations report, indigenous peoples continue to be over-represented among the poor, the illiterate, and the unemployed (United Nations, 2009). While indigenous peoples constitute approximately 5% of the world's population, they make up 15% of the world's poor and about one-third of the world's extremely poor rural people. Indigenous Chileans are no exception (Cerdeña, 2009) and according to Bedegral (2010, 2013), 1 in 2 rural Chilean children show developmental delays. One study of indigenous Mexicans living in conditions of poverty found that elementary school children demonstrated a significant delay in cognitive development (Morales, Contreras, González, & Díaz-Barriga-Martínez, 2014). Indigenous populations are severely under-represented in this area of research due to a very strong predominance of Western and urban samples (Henrich,

**Table 1**  
Descriptive statistics of child outcomes, EFs, parental caregiving, professional childcare, and family characteristics (N = 77).

	M	SD	Minimum	Maximum
<i>Child development</i>				
Problem behavior (61 mos.)	.43	.19	.40	.86
Prosocial behavior (61 mos.)	2.63	.45	1.49	3.72
Language ability (61 mos.)	–	1.79	–3.79	4.34
<i>Executive functioning</i>				
Task switching (61 mos.)	44.16	30.57	.00	100.00
<i>Parental caregiving</i>				
Quality of home environment (average 6–61 mos.)	74.43	6.85	56.70	88.72
Quantity of maternal care (61 mos.)	72.87	35.34	24.00	168.00
<i>Childcare</i>				
Quality of preschool (transition levels)	2.51	.78	1.31	4.80
Quantity of childcare (average 6–61 mos.)	47.79	24.02	5.12	92.75
<i>Family characteristics (61 mos.)</i>				
Maternal age (years)	31.30	7.60	21.00	49.00
Child age (months)	60.82	1.36	58.00	63.00
Maternal education	2.38	.95	1.00	4.00
Per capita income	2.34	1.15	1.00	5.00
SES <sup>a</sup>	–	1.68	–2.62	4.04
		N	%	
Ethnicity	Mapuche	31	40.30	
	Chilean	46	59.70	
Child gender	Male	48	62.30	
	Female	29	37.70	
Parents	Oneparent	32	41.60	
	Twoparents	45	58.40	

<sup>a</sup> Sum of z-score values with a mean of 0.

Heine, & Norenzayan, 2010). Cognitive and socioemotional child outcomes might be shaped by indigenous socialization practices and/or might be negatively affected by minority group status. It is of great importance to the field of behavioral and developmental science to include non-western populations to establish whether commonly found relations are shared cross-culturally, as the universal effects assumption states, or whether cultural differences occur (Norenzayan & Heine, 2005).

### 1.9. The current study

To advance research on predictors of preschool children's development in a Latin American context and encourage interventions, we examined how SES, ethnicity, child EFs, quality and quantity of caregiving environment, both at home and childcare, relate to individual differences in Chilean preschool children's socioemotional adjustment and language ability. We are the first to test the following hypotheses (based on Chilean findings where possible, otherwise based on Western research outcomes) in a bi-ethnic at-risk population consisting of indigenous Mapuche minority and Chilean majority families in the south of Chile:

- 1) How are SES, ethnicity, child EFs, and quality and quantity of caregiving environment related to individual differences in Chilean preschool children's socioemotional adjustment? We hypothesize that higher SES, ethnic majority status, higher levels of EFs, higher quality socialization environments (home and preschool), higher quantity of maternal care, and lower quantity of childcare predict less problem behavior and more prosocial behavior.
- 2) How are SES, ethnicity, child EFs, and quality and quantity of caregiving environment related to individual differences in Chilean preschool children's language ability? We expect that higher SES, ethnic majority status, higher levels of EFs, and higher quality socialization environments (home and preschool), lower quantity of maternal care, and more quantity of childcare predict more favorable language ability.

## 2. Method

### 2.1. Family sample and procedure

The current study is a follow-up of the longitudinal Magellan-Leiden Childcare Study, which started in February 2012 with 110 mothers and their 6-month-old infants (Cárcamo, Vermeer, Van der Veer, & Van Ijzendoorn, 2015). The initial sample was drawn from three public health centers and records of 19 public daycare centers in the Araucanía region and on Chiloé Island (Lake region) in the south of Chile. Attrition reduced the number of children in the final longitudinal sample. Of the initial 110 mother–child dyads, 95 (86%) were still participating at Time 2 (mean child age 15 months), 79 (72%) at Time 3 (mean child age 42 months), and 80 (71%) at Time 4 (mean child age 61 months). Reasons for non-participation included families having moved residence, not leaving any contact address or telephone number, families moving out of the study area, or reported time constraints (e.g. due to the birth of another baby). In the current study we report on Time 4 data (collected from August to October 2016) unless otherwise stated. Three dyads of the remaining 80 were excluded from analysis due to missing variables (two mothers did not fill in questionnaires and one child did not collaborate during the language tests), resulting in a final current sample of 77 mother–child dyads.

The Time 4 participants are from lower-class ethnic majority Chilean ( $n=46$ ) and ethnic minority indigenous Mapuche ( $n=31$ ) background. Mean household income per capita was 2.34 ( $SD=1.15$ ) on a 5-point scale according to national quintile distribution (for details about SES assessment see 'socioeconomic status' in the measures subsection). Mothers' educational level was distributed as follows ( $M=2.38$ ;  $SD=.95$ , on a 4-point scale): 16.9% had either only completed primary school or had not completed secondary school, 44.2% had completed secondary school, 23.4% had completed vocational school, and 15.6% had completed university studies. All primary caregivers were mothers; their mean age was 31 years and mean child age was 61 months. Forty-two percent of the children were raised by a single parent and 62% were boys. Characteristics of mothers and children are displayed in Table 1.

Ethical approval was obtained by the Ethical Committee Board of Leiden University (The Netherlands). Time 4 data were collected by six trained female undergraduate psychology students of the Catholic University Temuco, Chile. Participating dyads received two home visits between August and October 2016. Each home visit took approximately 90 min, and during the first visit the primary caregiver was informed about the subsequent data collection and invited to continue participating, after which the informed consent form was signed. During the home visits, the quality of the home environment was assessed and mothers filled out questionnaires about demographic information (parental education, employment, income, family and household composition), the child's health and childcare situation (home versus daycare), and the child's prosocial and problem behavior. Furthermore, the children's language and executive function abilities were tested. Tests were administered to all children according to a standardized sequential order and all testing was either audio or video recorded to be able to decide on scoring afterwards in the case of ambiguous answers. The participants received a CLP 10,000 (US\$ 15) voucher for a local supermarket or convenience store as remuneration for their collaboration.

## 2.2. Preschool sample and procedure

The 77 children participating in our longitudinal study were enrolled in 48 preschools (21 public, 26 private-subsidized, and 1 private) in the Araucanía and Lake region in the south of Chile. Our preschool sample appears to be fairly representative compared to the national school type distribution (only private schools were underrepresented). Of the 48 visited preschools, 11 had more than one class attended by at least one participating child (9 preschools had 2 classes and 2 preschools had 3 classes). This resulted in 61 observed classes, of which 14 classes were attended by more than one participating child (12 classes had 2 children and 2 classes had 3 children). Eighty-seven percent of the children attended the preschool transition level one (regular age 4–5) and 13% of the children attended the preschool transition level two (regular age 5–6), depending on the children's date of birth. The children had on average 2 teachers, and 18 of their classmates were present during the observation. The average classroom quality of the preschools was inadequate (see Table 1). Three-quarters of the classrooms demonstrated inadequate quality (mean score <3), one quarter were of minimal quality ( $3 \leq \text{mean score} < 5$ ), and none were of good quality (mean score  $\geq 5$ ). Subscale analysis revealed the following: space and furnishings ( $M = 2.5$ ); personal care routines ( $M = 2.7$ ), language-reasoning ( $M = 3.1$ ), activities ( $M = 2.1$ ), interaction ( $M = 3.0$ ), program structure ( $M = 2.2$ ). Only 'language and reasoning' and 'interaction' just made it into the minimal quality category, all other subscales fell into the inadequate category.

The preschool data were collected by the first and fourth author and three male psychology students of the Catholic University Temuco, Chile (for details about training see Measures section). Each preschool was visited once for about 3½ hours between August and October 2016. During the preschool visit the participating child's classroom was observed and his/her teacher interviewed to measure the process quality of the child's childcare experience. The majority of the classroom observations occurred during the morning. The observations were only conducted in the afternoon in the exceptional case that the children exclusively attended an afternoon program. Prior to the visits, the preschool directors were contacted (by phone, e-mail, or personally) by a research assistant or the first author to request authorization for the classroom observations. They were also provided with written information about the classroom observation and the purpose of the study before they (or the classroom teachers) signed the informed consent form. The participating child's parents were informed by a research assistant

and the non-participating children's parents were informed about the classroom observation by their teacher. The teachers received two didactic games worth CLP 12,000 (US\$ 20) for their classrooms as remuneration for their collaboration.

## 2.3. Measures

### 2.3.1. Problem behavior

The Child Behavior Checklist 1½–5 (CBCL) was used to obtain standardized maternal reports of children's externalizing and internalizing problem behaviors (Achenbach & Rescorla, 2000). The 99 items describe a wide array of behavioral problems, subdivided into eight subscales: emotionally reactive, anxious/depressed, somatic complaints, withdrawn, sleep problems, attention problems, aggressive behavior, and other problems. The CBCL has been administered in many countries around the world including Chile and its validity and reliability has been well established (Crijnen, Achenbach, & Verhulst, 1997; Lecannelier et al., 2014). The mother was asked to rate the occurrence of her child's problems in the preceding 2 months on a 3-point scale: 0 = not true (as far as you know), 1 = somewhat or sometimes true, and 2 = very true or often true. For the purpose of this study, only the 24 externalizing items and the 25 internalizing items were combined into a global indicator of child problem behaviors (mean score), because they correlated highly ( $r = .53$ ). In the current study internal consistency yielded a Cronbach's alpha of .88.

### 2.3.2. Prosocial behavior

We used the Child Conscience Measure (CCM) to assess children's prosocial behavior (Kochanska, DeVet, Goldman, Murray, & Putnam, 1994). The CCM originally consists of 100 items and ten subscales, of which only three were included in our study: guilt/remorse (18 items), concern over good feeling with parent after wrongdoing (8 items), empathic/prosocial response to another's distress (13 items). We chose these three subscales, because they were most indicative of the concept we intended to measure, as these items reflect observable (pro)social behaviors and according to the authors (Kochanska et al., 1994) they loaded on the same factor. The CCM has shown good psychometric properties (Kochanska et al., 1994). Mothers were asked to indicate the degree to which the 39 statements presented were false (0), a little false (1), neither true nor false (2), a little true (3) or true (4) about her child (e.g. "my child shares his/her candies with a crying friend, even without his/her parents telling him/her to do so."). The items of the three subscales were combined into a global indicator of prosocial behavior (mean score). Higher scores indicate higher prosocial behavior. In the current study internal consistency yielded a Cronbach's alpha of .80.

### 2.3.3. Language ability

Receptive vocabulary was assessed using the Spanish adaptation of the Peabody Picture Vocabulary Test (PPVT) called Test de Vocabulario en Imágenes Peabody (TVIP), because all participating children speak Spanish as their first language (Dunn, Padilla, Lugo, & Dunn, 1986). During test administration (15–20 min) the child is shown one of the 125 black and white test plates at a time and after the research assistant names one of the four objects on the test plate the child has to point to the correct picture. Like the PPVT, the TVIP has proven over the years to be a reliable and valid instrument for receptive vocabulary assessment in Chile and other Latin American countries (ACYF, 2003; Piñeiro et al., 2000; Strasser, Larraín, López de Lérida, & Lissi, 2010). In the current study the split-half (odd/even) sample reliability was .95. The test was administered based on basal and ceiling rules (base item = 8 consecutive correct answers; ceiling item = 8 consecutive responses containing 6 errors). The final score is the number of correct responses



between base and ceiling items. There were five missing scores due to child test refusal or experimenter error. Each child's missing score was estimated based on the particular child's percentile score on the Expressive One Word Picture Vocabulary Test. The Expressive One Word Picture Vocabulary Test – Spanish Bilingual Edition (EOWPVT-4-SBE) measures children's ability to generate words (Nancy, 2013). The child is shown one of the 180 color pictures at a time and after a prompting question by the research assistant has to generate the word that best describes the object, concept, or action. Test administration time is 15–20 min. The EOWPVT-4-SBE showed good validity and reliability (Cronbach's  $\alpha = .95$ ) for Hispanic children in the US (Nancy, 2013). In the current study the split-half (odd/even) sample reliability was .93. The test was administered based on basal and ceiling rules (base item = 8 consecutive correct answers; ceiling item = 6 consecutive incorrect responses). The final score is the number of correct responses between base and ceiling items. Receptive and expressive vocabulary were significantly correlated ( $r = .60$ ), and therefore they were combined into one global indicator of language ability by summing the standardized scores of both measures. One early suspension score (experimenter error) was replaced by an estimate based on the same child's percentile score on the TVIP.

### 2.3.4. Executive functions

The Dimensional Change Card Sorting (DCCS) task was chosen because it is a global indicator of EF abilities (Diamond, Carlson, & Beck, 2005; Kirkham, Cruess, & Diamond, 2003). The DCCS is shown to be a valid and reliable measure of EFs in pre-k and kindergarten in numerous countries including Latino and Hispanic contexts (Beck, Schaefer, Pang, & Carlson, 2011; Carlson, 2017). Like all task-switching paradigms, the DCCS requires children to resist the dominant response (inhibitory control), to flexibly adapt to changing situations (cognitive flexibility), and to keep rules in mind to some extent (working memory) (Diamond et al., 2005). The DCCS was administered by research assistants after an extensive training period (studying the instructions, watching a training video provided by Diamond, practice sessions, and a pilot home visit with non-participating children). In this task, after sorting cards according to a certain dimension (e.g. color), the child is required to begin sorting according to a different dimension (e.g. shape), followed by a mixed trial in which shape and color are offered in a pseudo random order. Test administration takes 10–15 min and the sorting cards match the model cards on two dimensions, consequently the child had to inhibit sorting according to the other dimension. The final scores are based on the mixed sorting game only, as it assesses children's task switching ability. One point was awarded for every correct switch (from color to shape or vice versa) of eleven total switch trials. The total scores were converted into percentage scores, where higher scores indicate more correct switches.

### 2.3.5. Quantity of maternal care and quality of home environment

Mothers reported how many hours they spend with their child per day on a typical work day and on the weekends. These time indications were summed, resulting in the total amount of hours the mother spends with her child per week. Six mother reports were incomplete and hence replaced with the group mean. The quality of the home environment was assessed using the Infant/Toddler Home Observation for Measurement of the Environment (IT-HOME; Caldwell & Bradley, 2003) at Time 1 and Time 2, when children were 6 and 15 months old respectively (for details see Cárcamo et al., 2015). The Early Childhood Home Observation for Measurement of the Environment (EC-HOME; Caldwell & Bradley, 2003) was used at Time 3 and Time 4, when children were 3½ and 5 years old. The IT-HOME and EC-HOME both consisted of two parts: an observation of the home environment followed by a semi-structured interview with the primary caregiver, each

part lasting approximately 30 min. The IT-HOME consists of 45 binary choice items (negative = 0, positive = 1) grouped in six subscales (responsivity, acceptance, organization, learning materials, involvement, variety) and the EC-HOME consists of 55 binary choice items grouped in eight subscales (learning materials, language stimulation, physical environment, responsivity, academic stimulation, modelling, variety, and acceptance). The scores are summed and provide an indicator of the quality of the home environment (higher scores = higher quality).

The HOME inventory has been administered in many countries around the world including Chile, and its validity for minority and low-SES groups has been well established (Bradley et al., 2001; Bustos-Correa, Herrera, & Mathiesen, 2001). The HOME assessments were performed by the research assistants after an extensive training period (studying the manual, discussing items, video-scoring, and a pilot home visit). At Time 1 and 2 the inter-rater reliability was established to a criterion of 80% agreement with expert criteria scores and the internal consistency was .58 (Cronbach's  $\alpha$ ). At Time 3 and 4 observers achieved an average agreement of 94% with expert scoring when inter-rater reliability was assessed, and the internal consistency of the instrument yielded a Cronbach's  $\alpha$  of .69 and .82 for Time 3 and Time 4 respectively. An accumulated HOME score was computed, indicating the overall quality of the home environment across all four time points by calculating mean percentage scores across the four measurements (note: there were six missing data points due to non-participation at Time 3 and two missing data points due to non-completion at Time 4). All four HOME measurements were significantly correlated; Pearson correlations ranged from .28 to .59.

### 2.3.6. Quantity and quality of professional childcare

The directors of the childcare centers in the Araucanía region and on Chiloé Island and collaborating JUNJI (National Council of Daycare Centers) and INTEGRA (National Network of Nursery Schools and Kindergartens) staff were contacted in order to obtain the children's childcare attendance from 2012 to 2015. They were asked to report how many days per month (of working days) the participating children attended childcare. The researchers and psychology students visiting the preschools for the classroom observations at Time 4 had access to the children's class register and copied their monthly attendance during the first semester 2016 (January–July). All collected data were converted into a total percentage score for each child's childcare attendance between 6 and 61 months, labeled 'quantity of childcare'. This included nursery schools (6–24 months), kindergarten middle levels (24–48 months), preschool transition level one (48–60 months) and in some cases preschool transition level two (61–72 months). We had incomplete data for three children (e.g. one semester missing), and these were replaced by the child's average attendance of the same childcare level (nursery, kindergarten or preschool).

The Spanish translation of the Early Childhood Environment Rating Scale-Revised (ECERS-R; Harms, Clifford, & Cryer, 1998; Harms, Clifford, & Cryer, 2002) was used to measure process quality, which refers to the actual experiences of children in preschool. The rating scale intended for children between 2.5 and 5 years of age has shown good reliability and validity internationally (Clifford, Reszka, & Rossbach, 2010; Peisner-Feinberg & Burchinal, 1997), including in Chile (Mathiesen, Merino, Herrera, Castro, & Rodríguez, 2011).

The ECERS-R includes a 3-h classroom observation period, followed by an interview with the classroom teacher (20–30 min). The ECERS consists of 43 items organized in seven subscales: space and furnishings; personal care routines, language-reasoning, activities, interaction, program structure, and parents and staff. Two items were deleted due to non-applicability (11 'nap/rest' and 37 'provisions for children with disabilities'), and one sub-scale



(38–43 ‘parents and staff’) was excluded due to its lack of relevance to the questions under study. Consequently, the following results are based on 35 of the 43 original items. All ECERS-R items are presented on a 7-point Likert-type scale ranging from *one* (inadequate), *three* (minimal), and *five* (good), to *seven* (excellent). ‘Inadequate’ indicates childcare that does not meet basic custodial care needs. ‘Minimal’ describes childcare that meets custodial needs and, to a lesser degree, basic developmental needs. ‘Good’ means that children’s developmental needs are met. ‘Excellent’ indicates high-quality personalized care. A mean score for the quality of preschools was calculated including the 35 items utilized. Internal consistency of the instrument yielded a Cronbach’s alpha of .90.

An expert trainer (HV, second author) instructed the first author (RL) on the ECERS-R (93% agreement within one scale point) and the third and fourth authors (CDH, RC) on the ITERS-R, the Infant/Toddler Environment Rating Scale-Revised (90% agreement within one scale point). After self-training on the ECERS-R, the third and fourth authors trained three psychology students from the Catholic University of Temuco (Chile). Inter-rater reliability was established to a criterion of 80% agreement within one scale point. The mean percentage of agreement across two consecutive observations, and one ‘refresher’ observation a few weeks later just before the start of data collection, was 86% (range 80–92%) for the students. Furthermore, we checked for observer drift after about half (45%) of the classroom observations and the mean percentage of agreement across observations was 90% (range 82–94%).

### 2.3.7. SES and ethnicity

SES and ethnicity are included as covariates in the main analyses of the current study. SES was determined based on maternal education and per capita income. The level of maternal education was self-reported in a questionnaire at Time 4 on a 1–4 point scale (1 = incomplete primary or secondary school; 2 = secondary school completed; 3 = vocational education; 4 = university studies). Eleven mothers did not report their educational level. In these cases, the missing data were replaced by maternal educational level at Time 3 as best estimate. At Time 4, mothers also indicated their total gross monthly household income in Chilean Pesos (CLP) divided by the number of household members. This resulted in five income per capita answer categories: (1) less than CLP 74,969 (US\$ 112), (2) between CLP 74,970 and 125,558 (US\$ 187), (3) between CLP 125,559 and 193,104 (US\$ 288), (4) between CLP 193,105 and 352,743 (US\$ 527), and (5) more than CLP 352,744 (US\$ 527). The socioeconomic categorization is based on the five quintiles of the Chilean Ministry of Social Development (CASEN, 2013b). Nine mothers did not report their income; in these cases, the missing information was replaced by the Time 3 income measure as best estimate. The maternal education level and per capita income level were combined into one global indicator of SES by summing the standardized scores of both measures. The ethnicity of the participating mother–child dyads was determined by self-report (Cárcamo et al., 2015). Dyads were defined as Mapuche when mothers stated that their children were growing up in a Mapuche family.

### 2.4. Data analysis plan

Child outcome measures, executive functioning, parenting and childcare measures, and SES were inspected for outliers defined as values with SDs greater than 3.29 above the mean (Tabachnick & Fidell, 1996). No outliers were found, and all variables were normally distributed. Pearson correlation coefficients were computed to inspect the bivariate associations between all variables.

Hierarchical multiple regression analyses (HMR) were conducted to test whether child problem behavior, prosocial behavior,

and language ability at 61 months varied as a function of child executive functioning, parental caregiving and professional childcare. The models included the following predictor variables: SES at 61 months, ethnicity (0 = Chilean, 1 = Mapuche), executive functioning at 61 months (percentage of correct switch trials), average quality of home environment from 6 to 61 months (percentage score), quantity of maternal care at 61 months (total amount of hours per week), quality of preschool at 61 months (mean score), and average quantity of childcare between 6 and 61 months (percentage score).

We performed multilevel (random intercept) analyses to corroborate the HMR results. Multilevel models are particularly appropriate for nested data, meaning that data for participants is organized at several levels. In our case the units of analysis are the preschoolers at a lower level, who are nested within contextual units (classrooms/preschools) at higher levels.

### 2.5. Analysis of sample attrition

We compared the dropouts with the remaining sample. An independent t-test indicated that there was a significant difference between the drop outs [ $n = 33$ ;  $M = 21.61$ ;  $SD = 4.66$ ] and the current participants [ $n = 77$ ;  $M = 27.00$ ;  $SD = 7.60$ ] in terms of maternal age [ $t(108) = -3.79$ ,  $p < .00$ ]. This was partly due to the tendency of mothers in their late teens or early twenties to be unavailable for participation at Time 4. A Chi-square test revealed that the dropout mothers significantly differed from the current sample on SES [ $\chi^2(1, N = 110) = 23.64$ ,  $p < .001$ ]. Almost all of the 33 families (97%) that discontinued their participation were from the lowest SES backgrounds. No differences emerged between the drop-outs and the current sample on child gender [ $\chi^2(1, N = 110) = 2.69$ ,  $p = .10$ ], ethnicity [ $\chi^2(1, N = 110) = .47$ ,  $p = .49$ ] and marital status [ $\chi^2(1, N = 110) = 1.82$ ,  $p = .18$ ].

## 3. Results

### 3.1. Sample inspection

We compared our sample to the large-scale nationally representative sample of the Longitudinal Survey of Early Childhood (Encuesta Longitudinal de la Primera Infancia, ELPI) on overlapping measures (Cárcamo et al., 2015). It is important to note that our sample earns less than the mean national monthly per capita income, and in terms of education our participating mothers are at the average level (the average educational level in Chile, however, is very low: 71% of the Chilean adult population has no post-secondary education, CASEN, 2013a). This is consistent with the characterization of our current sample as having a ‘low-socioeconomic status’. The HOME results of our study ( $M = 74.43\%$ ,  $SD = 6.85$ ) were in the typical range when compared to participants from low-SES backgrounds of the large nationally representative ELPI sample ( $M = 72.47\%$ ,  $SD = 4.44$ ).

Furthermore, we inspected possible ethnic differences. However, t-tests yielded no significant differences between the Mapuche minority group and the Chilean majority group on SES (income and maternal education), quality of preschool, quantity of childcare, quality of home environment, quantity of maternal care, problem behavior, prosocial behavior, and language ability.

### 3.2. Bivariate associations between predictors and outcomes

Pearson correlations were calculated for all variables (see Table 2). Child executive functioning, quality of home environment, and SES were each significantly positively associated with language ability. In addition, SES was correlated with the quality of the home environment and the quantity of maternal care. Mothers with a lower SES background provided lower quality home environments

**Table 2**  
Pearson correlations between demographics, EFs, parental caregiving, professional childcare, and child outcomes (N = 77).

		1	2	3	4	5	6	7	8	9	10
1	SES (61 mos.)	–									
2	Ethnicity <sup>a</sup>	.11	–								
3	Child executive functioning (61 mos.)	.19	–.10	–							
4	Quality of home environment (average 6–61 mos.)	.52**	–.03	.11	–						
5	Quantity of maternal care (61 mos.)	–.28*	–.04	–.08	.17	–					
6	Quality of preschool (transition levels)	.06	–.02	.01	–.05	–.02	–				
7	Quantity of childcare (average 6–61 mos.)	.10	–.03	.25*	.13	–.29*	–.02	–			
8	Problem behavior (61 mos.)	–.15	–.15	–.10	–.13	–.02	–.04	.01	–		
9	Prosocial behavior (61 mos.)	.03	–.10	.21	.04	.09	–.10	.09	.01	–	
10	Language ability (61 mos.)	.37**	–.15	.34**	.43**	.04	–.02	–.08	–.03	.16	–

\* p < .05.  
 \*\* p < .01.  
<sup>a</sup> 0 = Chilean majority, 1 = Mapuche minority.

**Table 3**  
Hierarchical regression analyses predicting problem behavior, prosocial behavior, and language ability from EFs, parental caregiving, and professional childcare (N = 77).

Predictors	Model 1		Model 2		Model 3	
	Problem behavior <sup>a</sup>		Prosocial behavior <sup>b</sup>		Language ability <sup>c</sup>	
	R <sup>2</sup> = .04	R <sup>2</sup> = .06	R <sup>2</sup> = .01	R <sup>2</sup> = .08	R <sup>2</sup> = .17	R <sup>2</sup> = .35
	f <sup>2</sup> = .04	f <sup>2</sup> = .06	f <sup>2</sup> = .01	f <sup>2</sup> = .09	f <sup>2</sup> = .20	f <sup>2</sup> = .54
	p = .21	p = .73	p = .61	p = .55	p = .00	p = .00
	β	β	β	β	β	β
SES (61 mos.)	–.14	–.09	.05	.09	.39**	.17
Ethnicity	–.14	–.16	–.11	–.09	–.19	–.13
Executive functioning (61 mos.)		–.10		.18		.31**
Quality of home environment (average 6–61 mos.)		–.08		–.08		.33*
Quantity of maternal care (61 mos.)		–.04		.16		–.01
Quality of preschool (transition levels)		–.04		–.11		–.02
Quantity of childcare (average 6–61 mos.)		.03		.08		–.22*

\* p < .05.  
 \*\* p < .01.  
<sup>a</sup> CBCL = Child Behavior Checklist (subscales internalizing and externalizing) (Achenbach & Rescorla, 2000).  
<sup>b</sup> CCM = Child Conscience Measure (subscales: empathy, feelings of guilt, restoring good feelings with parents) (Kochanska et al., 1994).  
<sup>c</sup> Test de Vocabulario en Imágenes = Spanish version of Peabody Picture Vocabulary Test (Dunn et al., 1986), Expressive One-Word Picture Vocabulary Test – four – Spanish Bilingual Edition (Nancy, 2013).

and more maternal care than their higher SES counterparts. Moreover, quantity of childcare was positively associated with child executive functioning and negatively associated with the quantity of maternal care. All other correlations were non-significant.

### 3.3. Predicting problem behavior, prosocial behavior, and language ability

As some of the observed children came from the same childcare setting, we had to deal with a hierarchical data structure. The 77 children came from 61 classes within 48 schools. However, the number of classes per school and the number of children per class were small (never larger than 3). In addition, 47 out of 61 observed classes were attended by only one participating child, resulting in partial overlapping within- and between-setting variance. Therefore, we performed multiple linear regression analyses to examine multivariate relations between predictors and outcomes as a starting point, and corroborated the results using a multilevel (random intercept) model. As expected, multilevel outcomes were similar to the outcomes of the multiple regression analyses and led to the same conclusions. Thus, we only report multiple linear regression analyses results.

Three two-stage hierarchical multiple regression analyses were conducted with child problem behavior, prosocial behavior, and language ability as respective outcome variables. SES and ethnicity were entered at stage one of the regression analyses to control for demographic background variables. Child executive functioning, quality of home environment, quantity of maternal care, quality of preschool, and quantity of childcare were entered at stage two

into each model. Problem behavior (Model 1) and prosocial behavior (Model 2) were not significantly predicted by the demographic background variables [ $F(2,74) = 1.60, p = .21$ ;  $F(2,74) = .49, p = .61$ ], or by any of the child and the caregiving variables [ $F(7,69) = .63, p = .73$ ;  $F(7,69) = .85, p = .55$ ]. Analyses conducted separately for externalizing and internalizing problem behavior also failed to yield significant predictors in the regression. Language ability (Model 3) was significantly predicted by SES at stage 1 [ $F(2,74) = 7.60, p = .00$ ], explaining 17% of the variance. At stage two, executive functioning, quality of the home environment, and quantity of childcare significantly predicted language ability [ $F(7,69) = 5.22, p = .00$ ] above and beyond SES and ethnicity. At this stage, executive functioning and quality of the home environment showed a positive association with language ability, whereas quantity of childcare showed a negative association with language ability. Together these predictors accounted for 35% of the variance in language ability. Table 3 shows the results of the hierarchical multiple regression analyses.

## 4. Discussion

Our findings provide insight into whether child EFs and socialization environments relate to socio-emotional adjustment and language ability in Chilean preschool children. We found that executive functions and the quality of the home environment were positively associated with language ability and that quantity of childcare predicted lower language ability.

The association between child EFs and language ability remained above and beyond the effects of SES and ethnicity, and is in line with our expectations based on earlier work in the US

(McClelland et al., 2007; Weiland, Barata, & Yoshikawa, 2014), but diverges from the first study in a Chilean context (Barata, 2011). It has been suggested that EFs could help children to improve their language ability, because they need to stay focused and hold information in mind in order to process language (Diamond, 2013). EFs (working memory and inhibitory control) have frequently been reported to be linked to lexical learning and literacy acquisition (Baddeley, 2003; Gathercole, Pickering, Knight, & Stegmann, 2004; Yoshida, Tran, Benitez, & Kuwabara, 2011). However, it is also conceivable that the pathways might be reversed: a larger vocabulary might help children to plan and control their behavior more effectively through self-talk (Fuhs & Day, 2011).

As expected, children growing up in higher-quality home environments (e.g. with more learning materials and language stimulation) across early childhood demonstrated higher language ability at preschool. This effect remained above and beyond the effects of SES and ethnicity, and is in agreement with prior Western (Connor et al., 2005; NICHD ECCRN, 2004), Latin American (Paxson & Schady, 2005; Walker et al., 2007), and Chilean research (Coddington et al., 2014; Lohndorf et al., 2018). Quantity of maternal care did not predict any language outcomes, which is consistent with findings from Western samples (Lucas-Thompson et al., 2010) and a Mexican study (Fernald et al., 2005), but inconsistent with findings from the large-scale nationally representative ELPI sample from Chile (Contreras & Thiveos, 2014). The ELPI study findings showed that maternal employment during the child's second year is associated with significant language gains (receptive vocabulary) in preschool, whereas our results failed to find an association between quantity of maternal care during preschool and preschoolers' language ability (receptive and expressive vocabulary). The apparently contradictory findings might be explained by three differences between the studies: (1) maternal employment is a less exact indicator of maternal care than directly measuring quantity of maternal care as was done in our study, (2) the use of only receptive vocabulary in the ELPI study versus the inclusion of receptive and expressive vocabulary in our study, and (3) assessments from the first year onwards in ELPI versus assessments during the preschool period only in our study. In light of Chile generally being a lower-income country (Chile is officially a high-income country due to the gross national income per capita being heavily skewed by Chile's financial oligarchy), where two-thirds of the population have a monthly per capita income of less than US\$ 389 (AIM, 2015), we would have expected Chilean children to benefit from spending more time in professional childcare as opposed to maternal care. Yet, the effect of quantity of childcare depends largely on the quality of childcare, and in our sample the quality of preschools appears insufficient to make a difference.

Unexpectedly, the quality of preschool environment did not predict any of the child developmental outcomes. Examination of the score distribution showed that there may have been range restriction (scores ranged from 1.3 to 4.8 on a 7-point scale), as three-quarters of the preschools demonstrated inadequate classroom quality, one quarter minimal quality, and none good quality (the mean score of 2.5 was low). Apparently, variations within the lowest range of preschool quality are not associated with differences in child developmental outcomes. This is in line with a recent literature review and a recent meta-analysis indicating quality thresholds in early care and education with regard to child outcomes (Burchinal et al., 2016; Zaslow et al., 2016). Moreover, childcare quality was measured at the group level and not at the individual level, which means that the childcare an individual child receives might differ from the childcare his/her peers receive.

Contrary to our expectations which were aligned with the compensatory hypothesis, children spending more time in childcare across early childhood showed less language ability. This result conflicts with prior Western, Latin American, and Chilean

research, which either found no relations (Contreras & González, 2015; NICHD ECCRN, 2000) or positive relations (Behrman et al., 2004; Bernal & Fernández, 2013; Cortázar, 2012; Luijk et al., 2015). However, a study in Ecuador also reported negative associations between quantity of childcare and language ability (Rosero & Oosterbeek, 2011). The low quality of preschool environments in our sample may not be sufficient to counteract economic inequity and low-quality home environments. Also, Strasser and Lissi (2009) reported that kindergarten teachers in Santiago de Chile dedicated very little time to language or literacy instruction, and that most of the time was spent on activities such as recess, snacks, going to the bathroom, and disciplining the children. In terms of language learning, adult-child ratios naturally are more favorable in a family than in childcare, but good quality preschool teachers compensate for this disadvantage by encouraging children to communicate during group time and free play. Our data shows that there was inadequate language stimulation by the teachers, scarce interaction among children, and insufficient free play. In other words, children lacked vital opportunities to practice their language abilities with teachers and classmates.

In contrast to our hypotheses, none of the predictors were associated with children's problem behavior or prosocial behavior. Based on the literature, we would have expected higher EFs, higher quality of home and childcare environment, more quantity of maternal care and less quantity of childcare to predict less problem behavior and more prosocial behavior (Brock et al., 2009; Burchinal et al., 2010; Erel et al., 2000; Lucas-Thompson et al., 2010; NICHD ECCRN, 2003a; NICHD ECCRN, 2003b; Schoemaker et al., 2013). A possible explanation for these unexpected findings may lie in the use of parent-report measures to assess problem behavior and prosocial behavior. Mothers could either have over-reported behavior due to their own emotional difficulties or have under-reported due to lack of awareness (Najman et al., 2001). We suspect that the latter might have been the case in our sample of low-SES, because most of our participating preschoolers spent a considerable part of the day in childcare, whilst their mothers worked or studied. Child behaviors could pass unnoticed, as the mother-child dyads spent relatively little time together. Inspection of the score distribution of child problem behavior showed that 92% of our participating children exhibited no problem behavior (<93<sup>rd</sup> percentile), 1% of the children fell in the borderline clinical range (93<sup>rd</sup>–97<sup>th</sup> percentile), and 7% were in the clinical range (>97<sup>th</sup> percentile). Participating children demonstrated few behavior problems, as could be expected in a non-clinical sample, and lack of variation might also be partly responsible for the null results. Our findings are inconsistent with a prior Chilean study reporting very high scores of problem behavior in preschool children aged 1½–5 years (Rescorla et al., 2011). A possible explanation for these diverging results could be differences in sampling and child age. We were unable to find norms or reference studies for children's prosocial behavior in a Latin-American context (outcomes appeared to show sufficient variability across the less prosocial to very prosocial spectrum).

SES and ethnicity did not predict child problem behavior or prosocial behavior. SES predicted language behavior, but EFs, quality of the home environment, and quantity of childcare overrode the effect of SES. This is a promising result in a sample from low-SES background, as it indicates that even marginal increases in SES favorably affect child language and that child EFs, the child's home environment, and childcare attendance possibly offer pathways for intervention. A prior Chilean study suggested that the quality of the home environment mediated the relation between SES and child language (Lohndorf et al., 2018). Practical implications lie in the improvement of the quality of the caregiver-child interactions, both at home and in childcare, as rich socialization environments provide a breeding ground for favorable child devel-

opment. The absence of ethnic differences in child outcomes seems consistent with prior findings, indicating that the majority of the Mapuche are largely indistinguishable from their Chilean counterparts of the same social class due to urbanization and acculturation to the dominant culture (Caniguan, 2012).

Strong points of the study are the inclusion of both indigenous Mapuche ethnic minority and Chilean ethnic majority families in the south of Chile, who are rarely represented in child development research, in combination with the longitudinal design and the use of self-report, task performance, interview, and observational measures obtained during home visits providing ecological validity (Fabes, Matrin, Hanish, & Updegraff, 2000). A notable advantage was the comprehensive examination of the children's socialization environments (the quality and quantity of maternal and professional care), and the inclusion of social, emotional, and cognitive outcome measures. Another strength was the direct assessment of quantity of maternal care rather than relying on less reliable maternal employment data, which do not provide clarity about the type and quantity of care. Moreover, we exclusively used measures with sound psychometric properties, and almost all our measures were culturally validated in Chile and/or Latin America, with the sole exception of the Child Conscience parent report measure, used to assess children's prosocial behavior.

Nevertheless, the present study also had some weaknesses, which should be considered when drawing conclusions about the findings. First, we acknowledge that thirty percent of the original family sample recruited at the baseline of the longitudinal study in 2012 was lost, and mothers who dropped out were younger and from the lowest SES level. Second, quality of preschool, and quantity of maternal care, were based on a single assessment at 61 months, whereas quality of the home environment and quantity of childcare were based on accumulated data from 6 to 61 months. Third, the use of parent report measures to assess problem behavior and prosocial behavior may not provide objective information on child behavior but rather may be biased by parent's perceptions. Therefore, future research could be improved by integrating alternative assessment methods for child socio-emotional adjustment which do not rely on parent reporting. Fourth, the lack of cultural validation of the prosocial behavior measure calls for caution when interpreting the findings. Fifth, the EFs measure we used focuses mainly on inhibition and cognitive flexibility, minimizing the demand on working memory through frequent rule repetition. Thus, future research might want to consider including a task that assesses working memory specifically in order to obtain a more complete understanding of the EFs processes underlying children's socio-emotional and cognitive development.

Our research design and its inherent limitations do not allow us to establish causality. Nevertheless, this study extends our knowledge regarding the interrelations between child and family characteristics, socialization environments and children's socio-emotional adjustment and language ability in the Latin-American context of Chile. The current study supports Bronfenbrenner's (2005) bio-ecological framework, which emphasizes the importance of child characteristics, socialization environments, and cultural and socioeconomic contexts for child development. The associations between EFs and language ability imply that children in Chilean preschools might benefit from concerted efforts to enhance EF development, which is in agreement with recent findings from Argentina (Lipina & Segretin, 2015). In addition to these findings at the child level, we examined the socialization level and could partially corroborate results from Lohndorf et al. (2018). The quality of the home environment plays a crucial role in the development of children's language ability, pointing to family processes as important pathways for interventions targeted at enhancing child language. Another surprising outcome was that children who spent more time in childcare during early childhood actually demon-

strated less language ability at preschool age. This finding might be related to the quality of pre-primary education. In this context, it is noteworthy that our results regarding the classroom quality of preschools in the Araucanía region were considerably less positive (on average inadequate) than those reported by other Chilean studies conducted in the Metropolitan or Bio-Bio regions, which found minimal quality (Herrera et al., 2005; Villalón, Suzuki, Herrera, & Mathiesen, 2002). This difference is likely due to the fact that the Araucanía region is one of the poorest and most rural, includes the largest regional indigenous population (31.3% Mapuche), and has less availability of qualified teachers (Henríquez, 2013; INE, 2012; Mizala & Romaguera, 2000). Our findings regarding the low quality of preschools are consistent with prior research from Latin America (Araujo et al., 2015; Berlinski & Schady, 2015; Sánchez Pacheco et al., 2017), and highlight the importance of educational quality and equity during the preschool years. This is in line with OECD and UNICEF recommendations, which state that adequately preparing children for school during the highly formative years of early childhood and leveling the playing field for disadvantaged children are key to Chile's long-term economic success (Hudson & Kühner, 2016; OECD, 2015). However, more longitudinal research is certainly needed to better understand how child characteristics and socialization environments (home and preschool) affect Chilean children's developmental trajectories in low-SES contexts during early childhood before we can pinpoint suitable areas for interventions. In conclusion, the current study confirms in a non-Western cultural context that parents providing stimulating and responsive homes contribute favorably to their children's language ability, and that child EFs play a vital role in this process. Furthermore, our findings regarding the inadequate classroom quality of preschools in southern Chile provide new evidence of the urgent need to improve the quality of Chilean children's pre-primary education as a catalyst for reducing social disparities.

## Conflict of interest

All authors declare that they have no conflict of interest.

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