



# The relation of school achievement with self-esteem and bullying in Chilean children

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## Abstract

Self-esteem and bullying and academic achievement measures are related in Western countries. However, evidence from other culture spaces is extremely sparse. To fill this gap, here, we analyze a wide range of relevant measures from 8,381 8- to 12-year-old Latin American children enrolled in the Early Childhood Longitudinal Survey in Chile. We considered the relationship of math achievement, receptive vocabulary, Grade Point Average (GPA), self-esteem and bullying. We found positive relationships between most achievement measures, and a negative relationship between self-esteem and bullying. Unlike the international literature, we found a stronger relationship between self-esteem and GPA, and a weaker relationship between bullying and GPA. Findings suggest that children's learning and their experiences at school are connected. Results provide useful information for stakeholders.

**Keywords** Self-esteem · Bullying · Math achievement · Receptive vocabulary · GPA

There is growing interest in understanding the relation between children's self-esteem and bullying experiences and their academic achievement (Berger et al., 2011; Menting et al., 2011). Self-esteem (Orth & Robins, 2014) and bullying (Olweus, 2013) measures refer to individual and relational constructs, respectively, whereas academic measures can include Grade Point Average (GPA) (Juvonen et al., 2011), receptive vocabulary (Sénéchal & LeFevre, 2014), and math achievement (Watts et al., 2014). Evidence suggests that these constructs are strongly interrelated. For example, language and literacy skills correlate with math achievement (Duncan et al., 2007; Purpura et al., 2011), math achievement and language skills correlate with GPA (Vaillancourt et al., 2013), self-esteem is negatively correlated to peer victimization (Tsaousis, 2016), and peer victimization is negatively correlated to GPA (Wang et al., 2014). There are mixed findings about the potential relation between self-esteem and GPA (Cvencek et al., 2018; Marsh & O'Mara, 2008). While findings point to very complex interrelationships between the above academic and non-academic variables, to our knowledge no study has

analyzed all these measures within a single framework. This study aims to fill this gap and examines relations between children's reports of bullying and self-esteem, GPA, and children's assessments of receptive vocabulary and math achievement. Furthermore, we report findings from Latin America, an economically very unequal geographic area of the world, seriously underrepresented in research: We analyzed data from a Chilean representative national sample of 8,381 children, collected between 2017 and 2018 (Ministerio de Desarrollo Social y Familia, 2019). The large sample allowed us to estimate effect sizes with high precision and to determine whether previous findings from Western countries replicate in the Latin American context and to provide data from an economically very unequal geographic area of the world, seriously underrepresented in research.

## Bullying and peer victimization

Bullying and peer victimization refer to significant physical, verbal, or other type of aggression between children. Bullying behavior intends to cause harm upon a targeted child or children, it happens with some repetitiveness, and the victims perceive a power imbalance that favors the perpetrator and precludes them from defending themselves (Olweus, 2013).

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Exposure to bullying can have long-term consequences and affect the trajectories of development of a stress response. As children grow, we could expect an increase in effortful engagement responses to stress (active ways of coping) and a decline in disengaged and involuntary responses (e.g. escape, denial). However, a study in the United States (US) that followed children during a 5-year period, from Grades 2 to 6, found that bullying affected children's stress response in early adolescence, preventing the development of effective coping mechanisms and sensitizing them to stress (Troop-Gordon et al., 2017).

In a sample of ethnically diverse children from the US, followed from Grade 6 to 8, peer victimization predicted children's lower grades and academic engagement. Peer victimization and academic performance were measured via self-assessment and a second informer (peers or teacher, respectively), providing robust results (Juvonen et al., 2011). Two meta-analyses studied long-term effects of being either the victim or the bully (Ttofi et al., 2011a, b). The mean age of victims was 12 years at the start of the study, and children were followed for 6.9 years on average. Victims had a higher probability of depression in the follow-up period, even when controlling for other 20 risk factors. Effect sizes were larger when the child went through this experience at a younger age (Ttofi et al., 2011b). On the other hand, being a bully at around 11 years of age predicted later criminal and antisocial behavior above other risk factors after a follow-up period of 5.4 years (Ttofi et al., 2011a). These results show different long-term consequences for the victim and bully, but these effects also entail costs for society's health and social support systems (Olweus, 2013).

### Self-esteem

Self-esteem refers to how people feel about themselves, assessing whether they are good people and if they are good at things that matter to them (Neff, 2011). Self-esteem is characterized by growth from adolescence to middle adulthood, stability over time, and predicts positive outcomes in relationships, work, and health (Orth & Robins, 2014). Levels of affection towards oneself range between high and low, where high self-esteem people usually perceive themselves as having valuable qualities. In the US, high self-esteem has been found to protect the sense of self-worth and regulate emotional responses when facing negative situations, such as failure (Brown et al., 2001). In the UK and Norway, self-esteem is strongly and negatively associated with emotional states such as non-clinical depression and anxiety (Millings et al., 2012; Moksnes et al., 2010). This relation suggests that self-esteem could play a protective role for children and adolescents' mental health, promoting positive feelings and views of themselves. During one school year, decrease in self-esteem was the strongest predictor of

increase in victimization in the US, regardless of gender and age (Guerra et al., 2011). A meta-analytic review of 121 independent studies supported the relation between self-esteem and bullying and peer victimization for children and adolescents (younger or older than 12.5 years, respectively). Bullying victims usually had low self-esteem and this relationship was stronger in childhood. On the other hand, the relation between bullying perpetrators and low self-esteem was weaker before than after adolescence (Tsaousis, 2016). This may indicate that promoting self-esteem in vulnerable children can be an effective strategy of intervention.

Morin et al. (2013) studied trajectories of self-esteem in Canada following 12-year-old children for a 4-year period. They found 4 trajectories of self-esteem levels: elevated (stable trajectory of high self-esteem), moderate (stable trajectory of the mean level of the sample), increasing (similar to low and moderate trajectories at the start, increased up to elevated levels around Grade 9, and remained high and stable), and low (unstable self-esteem trajectories). Elevated and moderate levels of self-esteem presented strong trait-like properties. Perceptions of school life predicted children's membership in one of these trajectories, whereas gender had a moderating effect. Important factors of school life were children's perceptions of school climate justice (fairness), instructional component (higher GPA and educative climate), perceptions of bonding climate and feelings of loneliness. The instructional component was especially relevant for boys and the relational component for girls. Adolescent boys tended to have higher self-esteem than girls (Moksnes et al., 2010).

### GPA

Vaillancourt et al. (2013) followed children from Grade 3 to 8 in Canada and found that GPA in Grade 5 weakly correlated with peer victimization. Longitudinally, reading, writing, and math in Grade 3 predicted Grade 5 GPA. Most GPA-related effect sizes, predicting either externalizing problems (physical or relational aggression) or school absences, were very weak ranging from 0.02 to 0.1.

A cross-sectional study of Grade 5 students from 50 elementary schools in Canada found that peer victimization negatively correlated with GPA, and individual-level school climate was positively correlated with GPA. Girls had significantly higher mean GPA than boys. Multilevel analyses showed that school-level school climate scores were positively correlated with GPA and victimization remained negatively related to GPA (Wang et al., 2014). These findings highlight the impact that peer victimization can have on GPA, and the value of promoting a positive school climate.

In the US, positive self-esteem was a significant predictor of higher GPA from kindergarten to Grade 2, but not in Grades 3 to 5 (Cvencek et al., 2018). A study with a sample

of German Grade 7 students in 1991, only found limited evidence to support the effect of self-esteem on math achievement and GPA, and some evidence of the effect of math achievement and GPA on self-esteem (Trautwein et al., 2006).

Two studies used the Youth in Transition longitudinal database collected in 1966 (Bachman & O'Malley, 1977; Baumeister et al., 2003; Marsh & O'Mara, 2008), which followed Grade 10 boys attending US public high schools. The review by Baumeister et al. (2003) stated that there was no evidence that self-esteem had a significant effect on GPA. Only weak positive correlations between self-esteem and GPA had been found in Grades 10 and 12). Using the same data set, Marsh & O'Mara (2008) found that only the path from Grade 11 self-esteem to Grade 12 GPA was marginally significant. However, the Youth in Transition data did not include girls nor early years of education, and it was collected more than 50 years ago.

### Receptive vocabulary

Receptive vocabulary entails recognition, a comparison between external and internal representations of a word, whereas expressive vocabulary includes the additional step of reproducing the phonological representation of a word. Receptive vocabulary acquisition requires opportunities to encode, associate and store novel information (Sénéchal, 1997). Receptive vocabulary has been related to children's reading comprehension, emotion knowledge, behavior, and peer rejection.

When studying the relation between comprehension skills in 4- to 6-year-olds in the UK, receptive vocabulary predicted reading comprehension a year later, mediated by inferential and literal comprehension of narrative. Inferential and literal comprehension refer to integrating implicit or explicit information in a text, respectively. Children need vocabulary knowledge to understand the explicit information in a text and to make inferences associating different concepts, supporting their reading comprehension development (Silva & Cain, 2015). In middle childhood in Germany, receptive vocabulary was found to strongly correlate to declarative emotion knowledge (explicit knowledge of emotional experience and expression) and awareness of mixed emotions (ability to assign two or more emotions to the same situation) (Beck et al., 2012).

In the Netherlands, children's receptive vocabulary at Grade 2 was found to significantly predict the slopes of the trajectories of both externalizing behavior (problems such as aggression and defiance) and peer rejection measured from kindergarten to Grade 4 (Menting et al., 2011): Children with smaller receptive vocabulary had higher risk of presenting externalizing behavior and being rejected by their peers (with risk increasing over time), whereas children with larger receptive vocabulary showed less externalizing

behavior and experienced less peer rejection. Increasing differences in peer rejection between children with poorer versus better receptive vocabulary mediated the relation between receptive vocabulary and the development of externalizing behavior. This mediation applied mostly to boys.

Sénéchal and LeFevre (2014) used the Home Literacy Model to study home literacy environment predictors of the acquisition of receptive vocabulary in children followed from kindergarten to Grade 2 in Canada. The home literacy environment consists of two dimensions: informal and formal literacy activities. In informal literacy activities print is present, but it is not at the center of the parent-child interaction, e.g. shared reading, where the focus is on the storyline or images but not on the print itself. In formal literacy activities, attention is focused on print, e.g. parents teaching their child the alphabet, writing, or reading. Shared reading at home was the only significant literacy activity that predicted receptive vocabulary growth from kindergarten to Grade 1.

In the US, preschool reading experiences can also predict later receptive vocabulary. Pre-K teacher's extratextual talk before, during, and after shared reading have significantly predicted kindergarten children's receptive vocabulary (Zucker et al., 2013). Preschool teachers' correcting utterances, children's and teacher's analytic talk during shared reading (e.g. exploring reasons behind characters' actions, discussing the meaning of words), and early home literacy support (e.g. frequency of reading, number of children's books) were significant predictors of receptive vocabulary at Grade 4, mediated by kindergarten receptive vocabulary (Dickinson & Porche, 2011). These results highlight the lasting effect of verbal interactions in the classroom on children's receptive vocabulary.

### Math achievement

Math achievement in high school correlates with college degree results, job earnings, and health care choices in the US (Lee, 2012; National Mathematics Advisory Panel, 2008; Reyna et al., 2009). These findings have promoted studies investigating early predictors of math achievement. Findings from US and UK longitudinal studies show that early math skills, measured in preschool or elementary school, are strong predictors of math achievement from 5 to 10 years later (Claessens et al., 2009; Siegler et al., 2012; Watts et al., 2014).

Language and literacy skills appear to have a significant relation with math achievement. A meta-analysis including six longitudinal data sets (four from the US, one from Great Britain, and one from Canada) found that three school-entry skills categories (reading/language, math, and attention) predicted later reading and math achievement. School-entry math was the most predictive across domains. School-entry math and school-entry reading were equally predictive of

later reading (Duncan et al., 2007). In the US, two early literacy skills, print knowledge (knowledge of letters, sounds, words, and how to look at books or prints) and expressive vocabulary, were significant predictors of math achievement a year later (Purpura et al., 2011). A longitudinal study in the US followed children from birth to Grade 1 to investigate predictors of math achievement in Grade 1. Potential predictors included: parenting, child-care, child characteristics, and Grade 1 classroom characteristics. The strongest predictor of Grade 1 math achievement was language skills at 4.5 years of age, a latent variable composed of three measures: receptive vocabulary, auditory comprehension, and expressive language. Indirect pathways lead from environmental factors (parenting context, child-care) through child characteristics (social skills, language skills) to mathematical achievement in Grade 1 (NICHD Early Child Care Research Network, 2004).

A German study assessing children from Grades 5 to 9 found support for a reciprocal effects model linking math-related emotion and math achievement (measured with both GPA and test scores), controlling for gender, intelligence, and socioeconomic status (Pekrun et al., 2017). Positive emotions, enjoyment and pride, positively predicted math achievement, in turn math achievement positively predicted these emotions. Negative emotions, especially anxiety and hopelessness, negatively predicted math achievement, and math achievement negatively predicted negative emotions. Gender had a significant effect on all measured emotions but anger: Girls reported less enjoyment and more anxiety related to math while having the same math achievement as boys. These findings confirm well to findings in the international literature of math anxiety (Caviola et al., 2021; Szücs & Mammarella, 2020).

### A Latin American country: Chile

The above review was entirely based on studies from Western countries, mostly from the US, Canada, UK, and Europe. In contrast, findings from non-Western countries are extremely sparse. Here, we focus on data from Chile, a Latin American country. Latin America remains one of the most unequal regions in the world. High levels of poverty and inequality of resources in the region are severe risk factors for child development. Educational results in Latin America are lower than results from developed countries, e.g. most children in Latin America reach the end of kindergarten with lower vocabulary than children from developed countries (Strasser et al., 2016; OECD, 2017). Most of the available evidence has been imported from the US and Europe. Relying on this data can overlook cultural differences and contextual particularities. Hence, there is a clear need for culturally relevant research linking to international data (Berger & Caravita, 2016). Child development research in

Latin America has made progress, but more local evidence is needed to advise policy makers and to help improve the design and evaluation of interventions and public policies focusing on childhood (Narea, 2016).

The Organization for Economic Co-operation and Development (OECD) developed a review about Chilean education between the years 2004 to 2016 (OECD, 2017). Children's learning outcomes were measured through the System to Measure the Quality of Education (Sistema de Medición de Calidad de la Educación, SIMCE), a national assessment for students in primary and secondary education, and the Programme for International Student Assessment (PISA) applied to 15-year-old students from OECD countries in 2015 measuring skills and knowledge in reading, mathematics, and science. Some of Chile's main strengths were better access to education than in other Latin American countries and longer participation in the education system. However, the main challenge remains the existence of considerable social inequities in the quality of education: students' socioeconomic status had the biggest influence on performance. Chile had the strongest results in Latin America but fell behind the average results of OECD countries in reading, math, and science. The learning gap equaled about one year of schooling for reading, 1.5 years for science, and 2 years for math. There were also significant differences between rural-urban population, provinces, and gender, favoring students living in cities and provinces with bigger incomes per capita. Boys performed better in science and math, and girls in reading. The gender gap in these subjects increased with age (OECD, 2017).

The Chilean educational context is characterized by neoliberal policies, which have led to a strong relationship between family SES and children's educational trajectories (Hascoët et al., 2021). This market-oriented education system works through a Public-Private Partnership policy framework, which assumes that competition between public and private schools is an effective means of promoting education quality and efficiency. However, the application of market mechanisms to education has promoted academic and social segregation. Providers compete for the best students, excluding those with the lowest performance. On the other hand, many families demand schools where their "social segment" is represented, avoiding the poor. Not all families can choose school due to financial, geographical, or social constraints. The Chilean education system thus has become characterized by its high inequality, with few significant improvements in performance (Bellei & Muñoz, 2020; Verger et al., 2016; Valenzuela et al., 2008). Since 2013, new policies aiming at increasing equity are gradually being implemented (e.g. schools receiving State funding are forbidden from selecting students, and parental co-payment of schools will be eliminated). Nevertheless, the long-term

effects of these policies are still under study (Valenzuela & Montecinos, 2017).

Teachers' positive and negative expectations about their student's achievement are influenced by school SES, with teachers from high SES schools having more positive expectations of their students. There was no effect of teaching experience, teacher or student gender on teacher expectations. However, bias by student gender was related to the area of learning, especially in low SES schools, with teachers working in low SES schools expecting girls to do better at reading and language, and boys to do better at mathematics. These results show that teachers' expectations might be biased by students' characteristics (Barriga et al., 2019). In Grade 7, students' math self-concept and perceptions of their teachers' learning expectations predicted their mathematics achievement, when controlling for their prior achievement (Espinoza & Taut, 2020).

Parental educational expectations are understood as the highest level of education parents think their child will achieve, based on their capacity to support their children's education, their perception of their child's skills and previous academic achievement, and influenced by the feedback received from teachers, especially in the case of low SES parents (Gubbins & Otero, 2020a; Hascoët et al., 2021).

Parents with higher expectations regarding numeracy and literacy achievement before Grade 1 engaged more frequently in formal home numeracy activities: mapping (e.g. recognition of printed numbers) and operational (e.g. learning simple sums). Parents had higher expectations for literacy than numeracy achievement (Susperreguy et al., 2020). In primary school children, parental educational expectations also predicted parental educational involvement at home and could even decrease the impact of SES (Gubbins & Otero, 2020a).

Parental educational expectations have been related to Grade 4 children's Language and Mathematics performance on SIMCE (Gubbins & Otero, 2016), and Grade 3 students' Language and Mathematics grades in low-SES schools (Gubbins & Otero, 2020b). Parental educational expectations (alongside children's math self-concept and family SES) are related to children's math achievement, after controlling for previous math achievement (Hascoët et al., 2021). However, further research is needed to analyze the temporal relationship between parental educational expectations and children's academic achievement (Gubbins & Otero, 2020b).

Chilean preschool parents' home numeracy and literacy activities usually have a focus on formal learning (e.g. recognition of letters, learning the order of numbers). These practices might be related to parental beliefs about the activities that foster numeracy and literacy skills and might reflect common practices within the Chilean educational system (Susperreguy et al., 2022). Maternal supportive discipline

(warm interactions in the context of behavioral control strategies) predicted five-year-old preschoolers' math and literacy skills above and beyond SES and ethnicity, and mediated the relation between SES and early math and literacy skills (Lohndorf et al., 2021).

In primary school (Grades 1 to 8), parents reported more involvement with activities at home (e.g. helping children with homework) than at school (e.g. events organized by the school). SES predicted involvement at home, with parents of children attending public schools having lower participation in school activities than those belonging to private and subsidized schools. Information shared by the school promoted parental involvement both at home and at school (Gubbins & Otero, 2020a). Grade 4 students (nine-year-olds) who perceived their parents as having a nourishing involvement style (e.g. parents who are aware of their children's grades, and praise them for their accomplishments) had higher Language and Mathematics performance on SIMCE, in comparison to a punitive involvement style (e.g. forcing to get good grades, reprimanding when getting a bad grade) (Gubbins & Otero, 2016).

**Chilean findings on bullying, self-esteem, receptive vocabulary, math achievement, and GPA** Bullying has been studied in relation to well-being. Students in lower grades (7 and 8) were more frequently bullied than students in Grade 9, with boys reporting more episodes of bullying than girls. Recently bullied students reported more symptoms (e.g. loneliness, difficulty sleeping, and suicidal thoughts) (Fleming & Jacobsen, 2009). Similarly, in 10- to 18-year-old students, being bullied was related to a perception of lower quality of life (Hidalgo-Rasmussen et al., 2015). Another study explored the moderating role of friendship quality dimensions (closeness, support, disclosure, and affection) in children in Grades 4 to 6. Disclosure, sharing personal and private information, and support were the two dimensions that interacted with victimization effects on socioemotional well-being, especially in the case of girls. For boys, only support was a significant and positive moderator. These gender patterns could be explained by differences in the requirements of social interaction (Cuadros & Berger, 2016).

Another study investigated psychological (e.g. Machiavellianism) and social (perceived popularity) motives for bullying in students from Grades 5 to 7. Adolescents were considered to be Machiavellian if they used any means to accomplish their goals ignoring the negative consequences to others. This psychological motive predicted the increase of bullying over time, and this relationship was enhanced by classroom prestige norms for relational aggression. Classroom prestige norms refer to what is valued and accepted among classmates, associating certain behaviors with popularity. Relational aggression are those behaviors that damage

relationships (e.g. exclusion). No differences were found for girls and boys (Berger & Caravita, 2016).

Collective self-esteem (assessment of personal, collective, and institutional activities and their sense of belonging) has been studied in three types of educational establishments in Chile (public, mixed, and privately funded). High school students (Grades 9 to 12) showed significant differences in their collective self-esteem, favoring students in private education to those in public education (Cuadros et al., 2021).

There are studies that have used instruments developed in Chile. Self-esteem (measured with the test “Test de Autoestima Escolar” (TAE; School self-esteem test) significantly differed between students in Grades 3 to 8, with self-esteem decreasing as students progressed to higher grades, a result that has been found in other Latin American countries. Gender differences appeared in Grade 6 and increased in Grades 7 and 8 in favor of boys (Marchant et al., 2017). Socioemotional well-being and two subscales of school climate, peer relationships and school infrastructure, (measured with the test “Escala de Clima Social Escolar” (ECLIS; School Climate Scale) were significantly related to an increase in GPA of students in Grades 5 and 6 (Berger et al., 2014).

In Grades 3 and 4, socioemotional well-being, self-esteem (reported by the student and by the teacher), school social climate, and social integration correlated positively and significantly with GPA of both girls and boys (the only exception was social integration in the case of boys). Significant predictors of GPA were self-esteem reported by the teacher and by the student (Berger et al., 2011).

In 8- to 11-year-old children, personal and contextual factors are related to their GPA. Teacher apathy (perceptions of disinterest, injustice), indiscipline, peer victimization, and aggression negatively predicted GPA. Normative adjustment (degree of adherence to school norms), positive interpersonal management (relations between teachers, families, and students), and peer social networks (degree of support and strengths of peer relationships) positively predicted GPA (Cerdeira et al., 2019).

Strasser and Lissi (2009) studied children’s literacy experiences both at home and in the classroom. At home, 54% of parents reported reading to their child at least once during the previous week, 58% of parents said they had more than 10 children’s books at home, only 60.6% of parents had bought books at a bookstore, and 73.8% of parents taught their child the alphabet at least once during the past week. These results suggest that children had less literacy experiences at home compared to children in the US, United Kingdom and Canada (Wasik & Hendrickson, 2004; Hansen & Joshi, 2008; Canadian Heritage, 2005). Explanations proposed were low income, high price of books, low access to printed resources (e.g. absence of public libraries in poor neighborhoods), and parental preference for school-like literacy activities (teaching letters

and words was the most common activity in this sample) over book sharing activities (low frequency of shared reading across income and educational level).

At school, preschool teachers dedicated around half of a kindergarten day to instructional activities, with a fourth of this time including language or literacy activities (between 15 and 30 min on average). The more time invested in explicit language and literacy instruction, the greater the number of letters learned and the bigger the increase in emergent writing scores. These results differ from what has been found in developed countries, where schools offer children more literacy experiences (Connor et al., 2006). However, these findings are closer to what has been reported in other Latin American countries, showing the need to be careful to not generalize findings from different populations (Strasser & Lissi, 2009). The authors suggest that the low frequency of language and literacy activities, both at home and at school, might explain why these measures did not predict receptive vocabulary learning in kindergarten.

More recently, Strasser et al. (2017) analyzed the role of print exposure on oral language (expressive vocabulary and listening comprehension) and reading (word reading and reading comprehension) in Chilean students who were followed from Grade 1 to Grade 2. Print exposure measured in Grade 1 had direct effects on all four outcomes during the same school year (consistent with studies in the US, Canada, and European countries), and indirect effects through Grade 1 reading comprehension in all Grade 2 outcomes. That is, achieving reading comprehension in Grade 1 is key for the development of literacy skills the following year. Exposure to books was an important factor for both literacy skills measured, even in Chile where it is hard to access beginner reader’s books for most children.

Math achievement has been studied mostly in relation to family influences. Del Río et al. (2017) found differential impacts of mothers and fathers on their kindergarten children’s math achievement. Parents with higher numeracy expectations for their child and low levels of math anxiety created more numeracy practices opportunities at home. Mother’s numeracy activities with their children (teaching them about numbers, quantities, and operations) predicted children’s early math achievement, and mothers promoted more numeracy activities with their daughters. Low SES mothers reported doing numeracy activities with their children more frequently than high SES mothers. This last result has not been found in previous studies and the authors suggest that low SES mothers’ self-report on shared numeracy activities might respond to social desirability, but further studies are needed to confirm this or other possible explanations. This study underscores the necessity to consider families’ numeracy attitudes and practices, and their SES when promoting math achievement.

In early elementary school children (Grades 1–3), children’s math achievement significantly correlated with school year, father’s and mother’s math achievement, father’s math anxiety, socioeconomic status and children’s explicit math self-concept (identifying themselves with math more than with language). Both mothers and fathers and children presented implicit stereotypes associating math with males. Mothers had more math anxiety than fathers, and it had a marginally significant effect on children’s math self-concept. In Grade 3, gender differences in math achievement emerged, with boys having better results than girls. These findings show that parents’ and children’s beliefs about math related to children’s math achievement in the first years of primary school (del Río et al., 2021).

## The current study

There are no Latin American studies examining the relation between math achievement, receptive vocabulary, GPA, self-esteem, and bullying in a single framework. Besides, Chilean samples are usually collected in the Santiago Metropolitan Region while data is lacking from nationally representative samples. Our study aimed to fill this gap, including assessments of math achievement and receptive vocabulary, GPA, and students’ self-reported self-esteem and bullying. We performed secondary analyses of a representative sample of the 8- to 12-year-old Chilean child population who participated in the ELPI survey (Encuesta Longitudinal de Primera Infancia; Early Childhood Longitudinal Survey) in 2017.

## Objectives

- To examine the relationship of children’s math achievement, receptive vocabulary, GPA, and children’s report of their self-esteem and bullying in a nationally representative sample of 8- to 12-year-old Chilean children.
- To examine whether results from Western countries replicate in a Latin American context.

## Hypotheses

First, we expected math achievement and receptive vocabulary to be related, as other language and literacy skills (reading, print knowledge, expressive vocabulary) have had a significant relation with math achievement in primary school (Purpura et al., 2011; Duncan et al., 2007; NICHD Early Child Care Research Network, 2004).

Second, we expected both math achievement and receptive vocabulary to relate to children’s GPA, since math achievement and language skills (reading and writing) have appeared to be strong predictors of GPA (Vaillancourt et al., 2013).

Third, we predicted that self-esteem and bullying would be negatively related, considering previous results linking lower self-esteem in bullying victims and the pervasive effects of bullying on well-being (Tsaousis, 2016; Guerra et al., 2011; Troop-Gordon et al., 2017).

Fourth, we expected that bullying and GPA would be negatively related, given the negative correlation between peer victimization and GPA (Wang et al., 2014; Juvonen et al., 2011; Vaillancourt et al., 2013; Cerda et al., 2019).

Finally, we did not have a hypothesis about whether self-esteem and GPA would be related, since the evidence is inconclusive (Berger et al., 2011; Cvencek et al., 2018; Trautwein et al., 2006; Baumeister et al., 2003; Marsh & O’Mara, 2008).

## Method

This study used cross-sectional data from the third wave of ELPI (Encuesta Longitudinal de Primera Infancia; Early Childhood Longitudinal Survey), collected in 2017 and 2018 in Chile. This survey aims to assess child development and characterize both the home and environment of a national representative sample, with the goal of informing public policy of childhood.

## Participants

We report data from 8,381 children (4157 girls, 4224 boys) attending primary education in 2017 (4.2% Grade 2; 19.2% Grade 3; 27.8% Grade 4; 27.4% Grade 5; 17.7% Grade 6; 3.7% Grade 7), who were enrolled in ELPI. The sample was representative of the population of children born between 2006 and 2009 ( $M$  age = 10.4 years;  $SD$  = 1.1; range = 8.3 to 12.6 years). Family income was between \$0 to \$13,700,000 Chilean pesos ( $M$  = 299,061,  $SD$  = 517,084). The highest level of education of most main caregivers was high school (16.2% primary school; 64.1% high school; 9.5% technical studies, 10.2% college degree or higher).

## Procedure

Families were visited twice at home by pairs of trained evaluators. Both the main caregiver and the child provided written consent to participate in the assessments. They filled separate questionnaires and performed individual tasks. At the end of the visits, the main caregiver was given an information sheet about children’s rights and resources on where to ask for support if needed, and the child received an age-appropriate book.

For the purposes of this study, we selected the main caregiver questionnaire for demographic information; the children questionnaire, which contained tests measuring

bullying and school self-esteem; finally, we included child tasks measuring math achievement and receptive vocabulary.

## Measures

**Bullying** ECLIS (Escala de Clima Social Escolar; School Climate Scale) (Aron et al., 2012) is a valid and reliable questionnaire for school-age children with Spanish as their first language. The aim of this instrument is to allow the visualization of the characteristics of the school context in a moment in time. This scale is answered by students and the complete version consists of 82 items organized in 4 areas: teachers (30 items), classmates (15 items), the school as an institution (10 items), and school infrastructure (27 items). The total scale has a Cronbach's alpha of 0,89.

Items are scored according to the level of frequency of (or agreement with) the given statement (never, sometimes, almost always or always). All items are scored one-way, and specific items that have a different direction need to be recoded.

In the ELPI study, only the bullying subscale was assessed, which belongs to the "classmates" area and examines children's perception of violence in the school (e.g. "My classmates make fun of me, they call me nicknames"). This is a negative subscale, where a higher score indicates a more negative assessment of this topic. This subscale has a Cronbach's alpha of 0,78.

**Self-esteem** TAE (Test de Autoestima Escolar, School self-esteem Test) (Marchant et al., 2002, 2016) is a self-report screening test standardized in Chile, valid and reliable (Cronbach's alpha: 0,79; Kuder Richardson 20 coefficient: 0,79; concurrent validity with Piers-Harris test: Pearson's Product-Moment correlation: 0,88). TAE was created choosing a selection of items from the Piers-Harris Children's Self-Concept Scale (Piers, 1984), with the aim to assess self-esteem within the school context in children between 3rd and 8th grade of Primary Education (ages between 8 and 13 years old). It does not include subscales, even though it includes questions regarding all Piers-Harris 6 original domains (Behavioral Adjustment, Intellectual and School Status, Physical Appearance and Attributes, Anxiety, Popularity, and Happiness and Satisfaction).

TAE consists of 23 items of yes or no answers (e.g. "My classmates think I have good ideas"). To score items, 1 point is given to each answer that reflects a positive self-esteem and 0 points for each answer that indicates a low self-esteem. Some items need to be recodified and then the total score can be calculated adding every point. Therefore, there is a maximum of 23 points. Total score

is a general measure of children's overall self-esteem, a higher score indicates a more positive self-assessment.

**GPA** Both mother and child questionnaires included a question about the range in which the child's average grades would be. In Chile, grades are graded between 1 and 7, with 4 being the pass grade. Ranges included: Less than 4.0, Between 4.0 and 4.9, Between 5.0 and 5.9, and Between 6.0 and 7.0.

**Receptive vocabulary** TVIP (Test de Vocabulario en Imágenes Peabody) is the Hispanic adaptation of the Peabody Picture Vocabulary Test, validated with the population of Mexico and Puerto Rico (Dunn et al., 1986). It was adapted for the Chilean population presenting very high internal consistency ( $K-R=0.98$ ) and a correlation of 0.95 between both versions (Strasser et al., 2010). It is administered individually and measures receptive vocabulary, evaluating the scope of vocabulary acquisition and children's verbal ability or intelligence. It has been considered a good indicator of school success.

TVIP has 125 items in order of increasing difficulty and uses words that are common in Spanish. It consists of a practice phase and an evaluation phase. Children point to 1 image from a booklet with 4 options, their choice is meant to represent the word that the evaluator has mentioned. Correct items are scored with 1 and incorrect items are scored with 0. Raw score is obtained by subtracting the number of mistakes to the last item applied. The practice phase does not add to the raw score. Standard TVIP score is obtained using Hispanic norms.

The split half reliability of the test is 0.93 (mean correlation corrected by the Spearman-Brown formula). Concurrent validity was assessed with respect to the Spanish version of the Kaufman-ABC scale, a cognitive development test (Kaufman et al., 1985). Correlations with the Kaufman-ABC scale were between 0.25 and 0.59 (overall score) and between 0.28 and 0.69 (performance scale) (Dunn et al., 1986).

**Math achievement** The Woodcock-Muñoz battery (Woodcock et al., 2005) is a Spanish adaptation of the Woodcock-Johnson Battery and consists of 2 instruments: Cognitive abilities and Achievement tests. In ELPI, 3 subtests of the Achievement tests were used to measure calculation, math fluency, and applied problems. The internal consistency reliability coefficients of these subscales are approximately 0.90. The reliability coefficients and standard errors of measurement from The Woodcock-Muñoz battery approximate those obtained from the Woodcock-Johnson III norming sample (Woodcock et al., 2005).

**Table 1** Descriptive statistics of child measures

Variable	Mean	SD	Observed Range
Receptive Vocabulary	116.89	17.82	55–145
Math	50.24	8.09	12–85.7
Self-esteem	19.21	3.55	0–23
Bullying	15.44	4.17	9–32

$N=8,381$

**Table 2** GPA frequency table

GPA range	$N$	%
<4.0	58	1%
4.0–4.9	442	5%
5.0–5.9	3255	39%
6.0–7.0	4626	55%

Calculation contains 45 items that increase in difficulty, it measures the ability to perform mathematical calculations (addition, subtraction, multiplication and division operations, and combinations of the four). Math fluency consists of 160 items that assess the ability to quickly solve simple addition, subtraction, and multiplication within 3 min. Applied problems involve 62 items increasing in difficulty, measuring the ability to analyze and solve mathematical problems. The child listens to the formulation of the problem, recognizes the procedures to follow and performs calculations. Visual support material is presented. For all subtests, the score is 1 for correct items and 0 for incorrect items. The standardization of the raw scores was carried out for the three subtests, based on the distribution of scores obtained in the ELPI 2017 sample, grouping boys and girls of the same age.

We created a composite score of Math Achievement, averaging these 3 subtests: calculation, math fluency, and applied problems, which were strongly correlated to each other ( $0.55 \geq r \leq 0.60$ ;  $p < 0.001$ ).

## Data analyses

Descriptive statistics were obtained for Receptive Vocabulary, Math Achievement, Self-esteem, and Bullying and frequency analysis was carried for GPA (see Tables 1 and 2, respectively). We conducted Spearman's correlations to examine associations between achievement measures (Receptive Vocabulary, Math Achievement, GPA), and Self-esteem and Bullying. Additionally, we included children's Age and School Year, and Family Income and main caregiver's Education Level. After checking that the four key assumptions of the test were met (linearity of the data, normal distribution of the residuals, residuals not correlated

with their fitted values, fit not depending on a single point), we ran regression analyses to test the contribution of Self-esteem and Bullying on each achievement measure. Analyses were done in R version 4.0.4 (2021-02-15) (R Core Team, 2021).

## Ethics

Ethical evaluation of ELPI 2017 was conducted and approved by the Ethics committee of Pontificia Universidad Católica de Chile. The database has been published online for research (Ministerio de Desarrollo Social y Familia, 2019).

## Results

### Zero-order correlations

Zero-order correlations for all variables are shown in Table 3. Positive  $r$  values indicate a positive correlation, with values of both variables increasing together, whereas negative  $r$  values indicate a negative correlation, with values of one variable increasing while values of the other variable drop. There were strong correlations between school year and age, self-esteem and bullying, math achievement and receptive vocabulary ( $r=0.91, -0.45$  and  $0.41$ , respectively). There were moderate correlations ( $0.29 \leq r \leq 0.31$ ) between math achievement and GPA, self-esteem and GPA, education level of the main caregiver and family income. There were weak correlations ( $0.21 \leq r \leq 0.24$ ) between education level of the main caregiver and receptive vocabulary, education level of the main caregiver and math achievement, GPA and receptive vocabulary, self-esteem, and math achievement.

### Regressions

Multiple regression analyses were used to estimate the effect of self-esteem and bullying (independent or explanatory variables) on children's math achievement and receptive vocabulary (dependent or outcome variables).

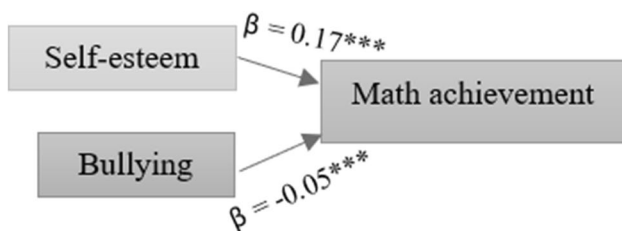
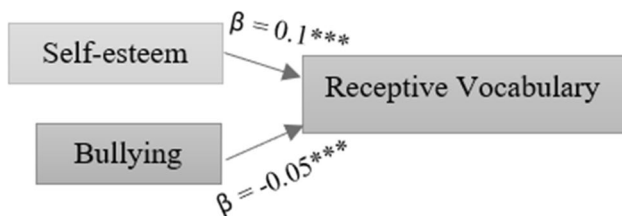
A model for math achievement, including self-esteem and bullying as predictors, explained 4% of the variance ( $R^2 = 0.04$ ,  $F(2,8379) = 179.3$ ,  $p < 0.001$ ). Self-esteem ( $\beta = 0.17$ ,  $p < 0.001$ , 95% CI [0.12, 0.23]) and bullying ( $\beta = -0.05$ ,  $p < 0.001$ , 95% CI [-0.1, -0.00]) weakly predicted math achievement (Fig. 1).

A separate model for receptive vocabulary, including self-esteem and bullying as predictors, explained 2% of the variance ( $R^2 = 0.02$ ,  $F(2,8379) = 72.15$ ,  $p < 0.001$ ). Self-esteem ( $\beta = 0.1$ ,  $p < 0.001$ , 95% CI [-0.03, 0.22]) and bullying ( $\beta = -0.05$ ,  $p < 0.001$ , 95% CI [-0.15, 0.06]) weakly predicted receptive vocabulary (Fig. 2).

**Table 3** Zero-order correlations

	1	2	3	4	5	6	7	8	9	10
1. Receptive vocabulary	1									
2. Math achievement	<b>0.41</b>	1								
3. GPA	<b>0.22</b>	<b>0.31</b>	1							
4. Self-esteem	0.13	<b>0.21</b>	<b>0.3</b>	1						
5. Bullying	-0.09	-0.11	-0.12	<b>-0.45</b>	1					
6. Age	0.01	0	-0.16	0.03	-0.03	1				
7. School year	0.01	0.01	-0.16	0.03	-0.03	<b>0.91</b>	1			
8. Sex	-0.04	-0.05	0.1	0.05	0.01	0	0	1		
9. Family income	0.09	0.08	0	-0.03	0	-0.01	-0.01	-0.01	1	
10. Education level (Main caregiver)	<b>0.24</b>	<b>0.22</b>	0.15	0.06	-0.07	-0.06	-0.05	0	<b>0.29</b>	1

Effect sizes of  $r > 0.2$  were highlighted with bold font

**Fig. 1** Regression model predicting math achievement**Fig. 2** Regression model predicting receptive vocabulary

An ordinal logistic regression analysis was conducted to estimate the effect of self-esteem and bullying (independent variables) on children's GPA (dependent variable). Both predictor variables were found to significantly contribute to the model ( $p < 0.001$ ). For every one unit increase in self-esteem the odds of having higher grades (between 6.0 and 7.0 or between 5.0 and 5.9) is multiplied by 1.21 (i.e. increases 21%) when holding constant the measure of bullying. With one unit increase in bullying the odds of having higher grades is multiplied by 1.02 (i.e. increases 2%) when holding constant the measure of self-esteem.

## Discussion

The present study investigated the relationship between children's self-esteem and bullying and academic achievement. Significantly extending the existing evidence base from mostly Western countries, here we analyzed a nationally

representative dataset of 8,381 eight to 12-year-old Chilean children from Latin America. This sample size is notably larger than that of many previous studies (149 to 5,648 participants; Berger et al., 2011; Cvencek et al., 2018; Guerra et al., 2011; Menting et al., 2011; NICHD Early Child Care Research Network, 2004; Pekrun et al., 2017; Trautwein et al., 2006; Wang et al., 2014), assuring precise effect size estimates. We included two widely used international tests that have been adapted for Hispanic population: TVIP (Test de Vocabulario en Imágenes Peabody) for receptive vocabulary (Dunn et al., 1986; Strasser et al., 2010) and the Woodcock-Muñoz battery for math achievement (Woodcock et al., 2005), which makes our results more comparable to those from studies using the English version of these tests. Further, we used two tests that have been developed in Chile: TAE (Test de Autoestima Escolar, School self-esteem Test) (Marchant et al., 2002, 2016) and ECLIS (Escala de Clima Social Escolar; School Climate Scale) (Aron et al., 2012).

First, we considered correlations between all variables. As hypothesized from the results of Vaillancourt et al. (2013), where math, reading, and writing weakly predicted GPA, we found a positive relationship between math achievement and GPA, and a weak relationship between receptive vocabulary and GPA. Resembling the results from the NICHD Early Child Care Research Network (2004) between applied problems and receptive vocabulary, we found a positive relationship between math achievement and receptive vocabulary. On the contrary, we found a stronger negative relationship between self-esteem and bullying than previous studies (Guerra et al., 2011) (Tsaousis, 2016). This suggests that for Chilean children, lower self-esteem is accompanied by more bullying experiences. The directionality of the results is unclear: It may be that more bullying experiences negatively affect self-esteem, or bullies may target children who have low self-esteem. Alternatively, higher self-esteem may protect against bullying experiences, or, when bullying ceases, children may restore their self-esteem. One

potential explanation for our data is that here the relationship between self-esteem and bullying was measured at a single time point. Hence, effects may have been stronger than in previous data that measured these variables at different time points (Guerra et al., 2011; Troop-Gordon et al., 2017).

For the sake of completeness, we also analyzed correlations with gender and found no significant effects. This is consistent with the review of Halliday et al. (2021) who found no gender differences in achievement. However, they found gender differences in emotional outcomes of bullying victims with girls having a higher risk for negative emotional outcomes. This means that, at least for the variables included in this study, girls and boys had similar experiences at school.

Regarding the relationship between achievement and self-esteem, we found a strong positive correlation between GPA and self-esteem, similar to a previous Chilean study (Berger et al., 2011). Notably, the effects sizes measured in Chile are much stronger than the ones reported in international studies (Cvencek et al., 2018;  $N = 149$  children) (Trautwein et al., 2006;  $N = 5,648$  children). This result might imply that academic performance has a stronger role in Chilean children's self-esteem and therefore higher (or lower) GPA may increase (or decrease) self-esteem. Education in Chile is regarded as a means for social mobility, with the responsibility to decrease the gap between the rich and the poor (Valenzuela et al., 2008). Therefore, parents from low or middle SES might expect their children to achieve high GPA, as this could provide them opportunities in the long term. We could hypothesize that children who perceive that they comply with their parents' expectations have higher self-esteem, whereas children who think they do not might see their self-esteem affected. On the other hand, children whose parents have higher expectations of them might have higher self-esteem and this in turn promote higher GPA. However, future studies including parental expectations are needed to test potential variables moderating the relationship between GPA and self-esteem.

Conversely, we found a notably weaker negative relationship between bullying and GPA, than in a large Canadian sample (Wang et al., 2014). This weaker relationship might suggest that in Chile, GPA is not affected as much by bullying experiences as in other countries. However, bullying did negatively impact self-esteem, and might indirectly impact academic achievement or have long-term effects beyond the scope of this study. This result opens the question about the factors that might be preventing bullying from having a stronger negative effect on GPA. In line with correlation results, our regression analyses indicated that self-esteem had a larger impact on the odds of having a higher GPA than bullying.

Regarding receptive vocabulary, we found weak correlations with self-esteem and bullying. The direction of these findings is consistent with previous reports on the relation

of receptive vocabulary and bullying (Menting et al., 2011). Smaller receptive vocabulary, i.e. lesser understanding or recognition of words, could become a risk factor for bullying in Chilean children. Such a relationship has been observed in the Netherlands, where children with poorer receptive vocabulary skills presented increasing externalizing behavior, and were more likely to be rejected by their peers (Menting et al., 2011).

Regarding math achievement, we found a strong correlation with self-esteem, but a weak correlation with bullying. Bullying had the same negative correlation with both math achievement and receptive vocabulary, whereas self-esteem had a positive correlation with these variables. Previous studies have reported similar relationships between positive emotions (enjoyment and pride) and math achievement and negative emotions (anxiety and hopelessness) and math achievement (Pekrun et al., 2017). Since we cannot tell the direction of a potential causal relationship, either better math achievement may have a positive effect on self-esteem or children with higher self-esteem are more likely to have better math achievement, or there may be a bidirectional relationship. As with the relationship with receptive vocabulary, we could hypothesize that lower math achievement might become a risk factor for bullying. Overall, results of self-esteem and bullying on GPA, receptive vocabulary, and math achievement suggest that there are better chances for higher achievement when children have a more positive self-esteem and there are fewer bullying experiences.

Our large sample size assured precise effect size estimates. This is especially important as some relevant effect sizes range from small to medium in comparable studies: GPA and self-esteem nationally ( $r = 0.32$  for boys,  $r = 0.27$  for girls) (Berger et al., 2011), and internationally ( $-0.01 \leq r \leq 0.03$ ) (Cvencek et al., 2018; Trautwein et al., 2006); GPA and bullying ( $r = -0.33$ ) (Wang et al., 2014); receptive vocabulary and bullying ( $\beta = -0.15$ ) (Menting et al., 2011); enjoyment and pride and math achievement ( $\beta$  range = 0.11 to 0.13) and anxiety and hopelessness and math achievement ( $\beta$  range =  $-0.08$  to  $-0.14$ ) (Pekrun et al., 2017). Small effect sizes could be due to the role that not examined moderating variables play in developing GPA, receptive vocabulary, and math achievement. There are numerous potentially relevant variables that were not included in our study, such as parent-child interactions promoting math and language skills (del Río et al., 2017; Sénéchal & LeFevre, 2014), the inclusion of teacher or peer reports of self-esteem and bullying (Juvonen et al., 2011), or considering earlier time-points of achievement measures (Duncan et al., 2007; Watts et al., 2014). Another explanation could be that self-esteem and bullying have a larger impact on socio-emotional skills (Brown et al., 2001) and measures such as stress, anxiety, or depression symptoms

(Millings et al., 2012; Troop-Gordon et al., 2017; Ttofi et al., 2011a, b) when compared to achievement measures.

Academic measures and self-esteem and bullying were highly correlated in our study (e.g. math achievement and receptive vocabulary; self-esteem and bullying) and previous studies (Guerra et al., 2011; Tsaousis, 2016). However, a meta-analysis of quasi-experimental evidence found that the effect of bullying on achievement was small (Schoeler et al., 2018), suggesting resilience of victimized children in the long-term. A review of the correlates of bullying suggests that emotional factors might have a larger role than social-cognitive processes in explaining the relationship between bullying and achievement and internalizing outcomes (Kretschmer, 2016), and this conclusion might also help us explain the small effect sizes found.

Despite relatively small effect sizes, our results demonstrate that bullying and self-esteem are factors to consider when interpreting children's math achievement, receptive vocabulary, and GPA. Understanding that children's self-esteem and bullying does play a role in their achievement and that intervening these may have an impact on emotional states and symptoms (Kretschmer, 2016), but also on their achievement. Working on improving children's self-esteem and decreasing bullying experiences can also be seen as a first step when planning achievement interventions (Samara et al., 2021). As we included 8- to 12-year-old children, our results can be used to design interventions that directly target bullying and self-esteem in primary school, enabling schools, policy makers, clinicians, and caregivers to provide adequate support to children.

A limitation of our study is the cross-sectional and correlational approach - this does not allow us to make causal inferences from our results. Longitudinal studies could analyze the long-term effect of self-esteem and bullying on achievement in similar underrepresented populations. Studies have pointed at the resilience of children who have experienced bullying and have overcome its negative consequences (Schoeler et al., 2018). Hence, it would be particularly useful to know what variables promote such resilience in victimized children. Future studies could also look at the mediators between self-esteem and bullying and achievement measures included in this study, to extend our understanding of the developmental pathways that can lead to different outcomes for children. Currently, only one meta-analysis has looked at cognitive and motivational mediators between bullying and achievement (Samara et al., 2021). Further, new studies could replicate our study at different time points, e.g. preschool and high school age groups. Additionally, it may be relevant to assess cyberbullying as a separate variable, as it may have a different impact on children than other forms of bullying (Halliday et al., 2021).

Our findings suggest that children's learning and their perceptions of their experiences at school are connected. We

highlight the need to consider the context and different relationships that are part of going to school. Our study provides information on an underrepresented population and extends our knowledge on the relation between academic and self-esteem and bullying measures in different contexts. We used a nationally representative sample from Chile, so the results are generalizable to a large population in Latin America. Stakeholders can use this information to design and evaluate interventions promoting child development. Studies in the field have highlighted the need for studies in developing countries, as most of the current evidence comes from Western, Educated, Industrialized, Rich and Democratic (WEIRD) countries (Halliday et al., 2021; Kretschmer, 2016; Samara et al., 2021).

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## Declarations

**Competing interests** The authors have no competing interests to declare that are relevant to the content of this article.

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