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A longitudinal study on moral emotions and psychosocial functioning among preschool children with and without hearing loss

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Abstract

Moral emotions such as shame, guilt and pride are crucial to young children's social-emotional development. Due to the restrictions caused by hearing loss in accessing the social world, deaf and hard of hearing (DHH) children may encounter extra difficulties in their development of moral emotions. However, little research so far has investigated the development trajectory of moral emotions during preschool years in DHH children. The present study used a longitudinal design to explore the development trajectories of shame, guilt, and pride, in a sample of 259 Chinese DHH and typically hearing (TH) preschoolers aged 2 to 6 years old. The results indicated that according to parent reports, DHH children manifested lower levels of guilt and pride compared to their TH peers, yet the manifested levels of shame, guilt, and pride increased throughout the preschool time at a similar pace in all children. Moreover, whilst guilt and pride contributed to increasing levels of psychosocial functioning over the preschool years, shame contributed to lower social competence and more externalizing behaviors in DHH and TH preschoolers. The outcomes imply that early interventions and adjustment to hearing loss could be useful to safeguard the social development of children with severe hearing loss, and cultural variances shall be taken into consideration when studying moral emotions in a Chinese cultural background.

Keywords: deaf and hard of hearing; development trajectory; moral emotions; preschool children

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Introduction

Moral emotions such as shame, guilt, and pride serve crucial social functions. Shameful and guilty feelings could function as emotional punishments, reminding individuals that some particular personalities or behaviors are undesirable within their society; whilst proud feelings reinforce similar behaviors in the future. Accordingly, moral emotions regulate individuals' behaviors, and motivate them to act in accordance to social norms (Tangney et al., 2007). Children's development of moral emotions relies on their social learning (Muris & Meesters, 2014). For children of preschool age, this process takes place primarily in parent-child interactions, and also in various social situations where children observe others' behaviors and overhear conversations. Social learning is the primary way for children to learn social norms and understand how social behaviors may be evaluated in different perspectives (Eisenberg et al., 1998). Nevertheless, access to the predominantly hearing social world can be difficult for deaf or hard of hearing (DHH) children (Rieffe et al., 2015), and such

difficulties may negatively affect their social learning and development of moral emotions. To date, studies exploring the development of shame, guilt, pride among DHH preschoolers are scarce, whereas these emotions are important to children's further development in many areas of psychosocial functions (Broekhof et al., 2020). To fill the gap, this study examined the development of shame, guilt, and pride in the preschool years in DHH children, as compared to their typically hearing (TH) peers, and explored how this may be related to their psychosocial functioning, using a longitudinal design.

Moral emotions and their developmental trajectory

Moral emotions are elicited by self-evaluations on one's personal attributes or behaviors in light of the prevailing social norms (Tracy et al., 2007). In particular, pride arises from positive self-evaluations, shame from negative self-images on one's own personal attributes, and guilt from negative arousal on having inflicted harm on others (Tangney et al., 2007). Consequently, experiences of pride may benefit children's social skills and facilitate prosocial behaviors (Da Silva et al., 2022; Ross, 2017); shameful feelings depreciate one's core self and could result in internalizing behaviors, such as withdrawal, avoiding social situations, and showing anxious symptoms and/or worrying (Li et al., 2023; Mills et al., 2015), or externalizing behaviors, such

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as acting out, throwing fits, disruptive, or aggressive behaviors (Heaven et al., 2009; Peng et al., 2018); whereas guilty feelings often lead to an urge to amend for wrongdoings, and an inhibition of aggression (Ding et al., 2016; Drummond et al., 2017). Accordingly, moral emotions play a crucial role in children's early social-emotional development (Calderon et al., 2011; Chao et al., 2015).

The capability of self-evaluation requires certain cognitive skills (Tracy et al., 2007): children ought to have awareness of the self, of the social norms, and the ability to take others' perspectives, in order to carry out self-evaluations. Research showed that children can show self-awareness from the age of two (Bulgarelli et al., 2019), and have basic understandings of social norms or values already in toddlerhood (Hardecker et al., 2016). With increasing perspective taking capabilities (Broekhof et al., 2015), children start to manifest moral judgmental expressions around three years of age (Gummerum et al., 2016; Krettenauer et al., 2013; Pluta et al., 2023), showing early signs of shame, guilt, and pride (Da Silva et al., 2022; Li et al., 2023). Prior research found that behaviorally manifested levels of guilt and pride increase rapidly during the preschool age (Bafunno & Camodeca, 2013; Da Silva et al., 2022; Ketelaar et al., 2015; Lapan & Boseovski, 2017; Ongley & Malti, 2014), whereas the manifestation of shame remains static in early childhood (Li et al., 2021; Ross, 2017; Sette et al., 2019). Notably, the abovementioned developmental trajectories were concluded from studies focused on TH children, whereas the situation may be different when moral development is affected by hearing loss.

Social learning and moral emotions in DHH children

Most DHH children are born to hearing parents who have no prior experiences in interacting with individuals with hearing loss (Mitchell & Karchmer, 2004), whereby the lack of proficiency in fine-tuning the communication with their DHH child could negatively affect their parent-child interactions. For example, obstacles may exist in the processes when DHH children try to follow their parents' instructions, or to understand verbal feedback upon their recent behaviors and performances (Ketelaar et al., 2015). Accordingly, it is usually more difficult for parents to share or to bond with their DHH child, because they must rely on short and simple verbal language or rudimentary sign language for communication (Calderon & Greenberg, 2011). As a consequence, the parent-child interaction for DHH children involves less in-depth communication on understanding others' emotions or taking others' perspectives, which may negatively impact the psychosocial functioning of DHH children (Dirks et al., 2020; Morgan et al., 2014).

The challenges in social communication and interaction cannot be solved completely even if DHH children's hearing abilities are assisted by hearing equipment. DHH children may still experience difficulties in following verbal conversations even with the help of hearing aid (HA) or the cochlear implant (CI), especially in situations where loud background noises, interference cues, or multiple sound sources are present, or when the speaker is not facing (right to) them (Caldwell & Nittrouer, 2013; Misurelli & Litovsky, 2015). Furthermore, during interactions with peers, DHH children can easily miss verbal cues when their attention is not fully focused on the speakers (Calderon & Greenberg, 2011). Even when their attention is focused, they may receive only partial information due to interferential background noise (Leibold & Buss, 2013). As most of their cognitive resources might be allocated to verbal cues, in combination with limited access to daily social

interaction as described above, DHH children may also miss or misinterpret nonverbal cues during communication, which are similarly crucial for successfully navigating social situations (Rudner & Holmer, 2016; Tsou et al., 2021). The difficulties in receiving information during interpersonal interactions can limit the opportunities for social learning: DHH youths may struggle to acquire social knowledge or practice cognitive skills through social learning, unlike their TH peers who do so as part of their daily routines (Calderon & Greenberg, 2011; Netten et al., 2015; de Villiers & de Villiers, 2014).

Restricted access to social learning can affect the early development of moral emotions in DHH children (Tracy et al., 2007). Cross-sectional research showed that DHH children displayed lower levels of shame, guilt, and pride compared to their TH peers, with these differences apparent as early as preschool age (Ketelaar et al., 2015). This pattern seems to maintain throughout the childhood as showed by studies on shame and guilt among DHH adolescents (Broekhof et al., 2018, 2020, 2021). Despite the atypical development of moral emotions among DHH children, similar associations between moral emotions and psychosocial functioning were found in DHH and TH children. Specifically, higher levels of shame were found to contribute to predicting more internalizing or externalizing behaviors in both DHH and TH children, whereas higher levels of guilt contributed to predicting fewer externalizing symptoms (Broekhof et al., 2018, 2020). Furthermore, positive associations between pride/guilt and social competence were found in DHH and TH preschoolers (Ketelaar et al., 2015; Li et al., 2023), although such results were not consistently found in elder children or adolescents (e.g., Roos et al., 2014; Stuewig & McCloskey, 2005). These findings thus highlight the importance of moral emotions to children's psychosocial functioning.

Present study

To date, most research on moral emotions in DHH and TH children used a cross-sectional design focusing on group differences of moral emotions between DHH and TH children. However, little is known about how shame, guilt, and pride develop in preschool years in DHH children. To the best of our knowledge, only two longitudinal studies examined this in school-aged children and adolescents, using self-reports (Broekhof et al., 2021; Mazzone et al., 2016). They found that the levels of shame and guilt increased during late childhood and early adolescence in both TH and DHH youth. The present study planned to use a longitudinal design to investigate the development of shame, guilt, and pride among DHH and TH preschoolers, based on parent reports. Prior research has shown that expressions of moral emotions can be observed in the behaviors of children from the age of two years (e.g., Gummerum et al., 2016; Krettenauer et al., 2013; Pluta et al., 2023), and that these observed behaviors can be reliably reported by parents (Kochanska et al., 1995).

Our first goal was to compare the levels of behavioral manifestations of shame, guilt, and pride in both DHH and TH children, examining if there was any group difference. According to prior research, we expected lower manifestation of shame, guilt, and pride in DHH preschoolers than TH peers (e.g., Broekhof et al., 2020; Ketelaar et al., 2015).

The second goal was to investigate the development of shame, guilt, and pride during the preschool years in both DHH and TH preschoolers. For TH preschoolers, we expected stable levels of shame over time, but increased levels of guilt and pride (e.g., Li

et al., 2021; Ongley & Malti, 2014). As for DHH preschoolers, due to a lack of empirical evidence, we could only infer from research on older DHH children (Broekhof et al., 2021; Mazzone et al., 2016) and assumed that DHH preschoolers might have a similar developmental trend as their TH peers.

Our third goal was to investigate the longitudinal associations of shame, guilt, and pride with psychosocial functioning (i.e., internalizing and externalizing behaviors, social competence) in DHH and TH preschoolers. Based on prior correlational research on TH children (e.g., Ding et al., 2016; Mills et al., 2015; Ross, 2017), we expected that for TH preschoolers, their manifested shame levels would contribute to more internalizing behaviors (e.g., social withdrawal, worrying, and anxious behaviors) and more externalizing behaviors (e.g., acting out, disruptive, and/or aggressive behaviors) (e.g., Gadow et al., 2001; Heaven et al., 2009; Peng et al., 2018; Sprafkin et al., 2002); their levels of guilt contributed to better social competence and fewer externalizing behaviors; and their manifestations of pride contributed to better social competence over time. For the DHH group, we assumed that the abovementioned associations might be similar in DHH preschoolers as in their TH peers (Broekhof et al., 2018; Ketelaar et al., 2015).

Method

Participants

A total of 259 Chinese DHH and TH children (DHH: 123; TH: 136) aged from 21 to 84 months ($M = 49.22$ months, $SD = 12.65$ months, at the first wave) participated in this study. Two waves of longitudinal data were collected upon this sample with an interval of 14.61 months ($SD = 4.31$ months).

The participants were recruited via the China Rehabilitation Research Center for Hearing and Speech Impairment (CRRCHSI) during 2019 to 2020. CRRCHSI is a national research institution providing early interventions for children with hearing loss in China. CRRCHSI has a center-affiliated kindergarten, which hosts both DHH and TH children. DHH children first attend classes which are specially designed for DHH children. After one to two years, depending on the DHH children's language and cognitive development, DHH children are allocated to mixed classes where they have classes and interactions with TH peers. During their stay in the center, the DHH children received early interventions and special education to promote their language and social development. CRRCHSI emphasizes the development of spoken language, and thus signed language is not used as a language of instruction.

The DHH participants recruited from CRRCHSI had severe hearing losses, with average unaided hearing thresholds of 77.73 dB at the better hearing ear and 86.75 dB at the worse hearing ear. 86.9% of the children used HA or CI (mean aided hearing thresholds: 23.10 dB at better hearing ear; 33.44 dB at the worse hearing ear). The demographic characteristics of both the DHH and TH participants, and the hearing status of the DHH participants are shown in Table 1. When comparing between groups, no difference was found in terms of mean age, mean IQ scores, or the means of the social-economic variables.

The inclusion criteria for DHH preschoolers were: (1) pre-lingual (younger than three years of age) hearing loss with a minimum hearing threshold of 40 dB in the better ear (calculated by averaging unaided hearing thresholds at 500, 1000, 2000, 4000 Hz); (2) an adequate cognitive development (i.e., nonverbal IQ >80); (3) no other disabilities or developmental disorders. The inclusion criteria for TH preschoolers were: (1) with no delays in

their cognitive development (i.e., nonverbal IQ >80); (2) without any disability or developmental disorder.

Nonverbal intelligence (IQ) of the participants were evaluated by teachers and researchers at CRRCHSI, using the Griffiths Development Scales for China (original version: Griffiths & Huntley, 1996; Chinese version: Tso et al., 2018), which is a validated instrument with standardized norm scores widely used in China. We retrieved participants' IQ scores from CRRCHSI, under the permission of children's parents and the teachers.

Procedure

Prior to the data collection, the research protocol of the present study was approved by the ethics committee of Leiden University and CRRCHSI. The two waves of data collection were conducted with the help of the teachers from the center-affiliated kindergarten. Prior to data collection, the researchers provided the teachers instructions on data collection to ensure that the procedure could be carried out correctly.

Before the data collection, the parents/caregivers of the children were provided detailed information on the goals, execution, data management, privacy policy of this study, as well as the voluntary nature of participation, and they were requested to sign an informed consent. After receiving the informed consent from the parents/caregivers, the teachers distributed the paper-form questionnaires to the children, who brought the questionnaires home to their parents/caregivers. After the parents/caregivers completed all the questionnaires, they gave the questionnaires to their child to bring them back to the center-affiliated kindergarten. The teachers collected the questionnaires and gave them to the researchers. For those caregivers who preferred to fill in the questionnaires online, a link was sent to them by email.

Measures

Moral emotions (shame, guilt, pride)

To assess shame, guilt and pride, the Chinese version of Moral Emotion Questionnaire (MEQ) (Li et al., 2023) was administered. This questionnaire was translated from the Dutch MEQ (Da Silva et al., 2022), and validated in a sample of Chinese children with satisfactory factorial validity and reliability across sex and age groups from 2 to 6 years. This MEQ is a parent-report questionnaire that assesses behavioral responses of three distinct moral emotions shame, guilt, and pride, in children aged 2 to 6 years. It has 15 items, encompassing: "Shame" scale (4 items), "Guilt" scale (4 items), and "Pride" scale (7 items). The respondents were instructed to rate how each item represented their child's behaviors in the past two months, on a 3-point scale (0 = never, 1 = sometimes, and 2 = often). A higher score indicated a higher behavioral tendency of their child to experience each described emotion. The respondents were encouraged to answer all the items, even when some items may be considered as not applicable to their child.

Internalizing and externalizing behaviors

To evaluate the severity of internalizing and externalizing behaviors, the Early Childhood Inventory 4th edition (ECI-4, Sprafkin et al., 2002) parent checklist was used. Since no Chinese version of the ECI-4 was available, we applied a back-translation procedure to the translation (Brislin et al., 1973): First, the questionnaire was translated from English to Chinese by a researcher who was proficient in both languages. A back-translation, from Chinese to English, was conducted later by

Table 1. Characteristics of the participants

	Time 1		Time 2	
	DHH (<i>n</i> = 123)	TH (<i>n</i> = 136)	DHH (<i>n</i> = 64)	TH (<i>n</i> = 66)
<i>Personal Characteristics</i>				
Age, months, mean (<i>SD</i>)	49.88 (15.69)	51.00 (10.05)	63.23 (15.78)	63.32 (8.02)
Gender, <i>n</i> (%)				
Male	72 (58.5%)	71 (52.2%)	36 (53.7%)	33 (52.4%)
Female	51 (41.5%)	65 (47.8%)	31 (46.3%)	30 (47.6%)
Nonverbal intelligence score ^a , mean (<i>SD</i>)	100.23 (16.10)	106.21 (10.60)	98.28 (14.41)	104.32 (13.52)
<i>Socioeconomic Status, mean (SD)</i>				
Maternal Education ^b	3.63 (0.89)	4.07 (0.93)	3.59 (0.93)	3.89 (1.08)
Parental Education ^b	3.61 (0.86)	4.11 (0.85)	3.63 (0.84)	3.91 (1.03)
Annual household income ^c	4.11 (0.85)	3.71 (0.86)	3.12 (1.79)	5.00 (1.97)
<i>Hearing Characteristics</i>				
Age of Identification, months, mean (<i>SD</i>)	14.78 (14.87)		16.66 (14.98)	
Hearing device, <i>n</i> (%)				
CI (unilateral / bilateral)	22 (17.89%)		8 (13.56)	
HA (unilateral / bilateral)	27 (21.95%)		10 (16.95%)	
Using both CI + HA	58 (47.15%)		39 (66.10%)	
Others/Unknown	16 (13.01%)		7 (11.86%)	
HA use, months, mean (<i>SD</i>)	22.53 (13.09)		21.36 (12.47)	
CI use, months, mean (<i>SD</i>)	18.32 (11.78)		17.05 (10.79)	
Unaided Hearing threshold, better ear, mean (<i>SD</i>) ^d	77.73 (29.72)		81.98 (27.89)	
Unaided Hearing threshold, worse ear, mean (<i>SD</i>) ^d	86.75 (28.02)		89.61 (28.53)	
Aided Hearing threshold, better ear, mean (<i>SD</i>) ^d	23.10 (14.48)		31.87 (18.52)	
Aided Hearing threshold, worse ear, mean (<i>SD</i>) ^d	33.44 (21.55)		40.22 (20.61)	

Note. DHH = deaf and hard-of-hearing; TH = typical hearing; HA = hearing aid; CI = cochlear implant; SD = standard deviation. ***p* < .001, **p* < .05 between DHH and TH children.

^aIQ scores were evaluated using the final scores of the Griffiths Mental Development Scales.

^bMean (SD) for each condition. Values: 1 = "Primary school & below," 2 = "Junior high," 3 = "High school," 4 = "University or College," 5 = "Postgraduate & above."

^cMean (SD) for each condition. Values: 1 = "<CNY20,000"; 2 = "CNY20,000-100,000"; 3 = "CNY110,000-150,000"; 4 = "CNY160,000-200,000"; 5 = "CNY210,000-300,000"; 6 = "CNY310,000-500,000"; 7 = "CNY500,000-1,000,000"; 8 = "> CNY1,000,000."

^dThe values referred to the hearing threshold of either the left or right ear, of different degrees of hearing loss. The better ear should have lower hearing threshold, the worse ear have higher hearing threshold.

another bilingual researcher. The translation scripts were examined for language consistency by the research team. Any inconsistencies (of languages) were resolved by discussions in the research team.

The ECI-4 consists of 9 subscales and 108 items screening for 15 emotional and behavioral disorders in preschoolers or children. The caregivers of the participants were instructed to rate how their child manifested each described symptom on a 4-point scale (0 = never, 1 = sometimes, 2 = often, 3 = very often), based on their child's behavioral manifestations in the past two months. A higher score indicated a more severe behavioral symptom.

Following the method of Ketelaar et al. (2017), we used four scales of the ECI-4 to assess children's "Internalizing Behaviors," which include: the "Major Depressive Disorder" scale (10 items, e.g. "Being too shy in front of their peers"); the "Separation Anxiety" scale (8 items, e.g. "Cannot fall asleep without parents staying around"); the "Social Phobia" scale (3 items, e.g. "When put in uncomfortable social situations, the child cries, freezes, or withdraws from interacting"); the "Generalized Anxiety" scale (4 items, e.g. "Cannot get rid of worrying thoughts"). We calculated

the grand mean of the scores that the caregivers gave on the items from the four scales and used this mean score as the indicator of the broadband internalizing behaviors.

Two scales of the ECI-4 were selected and combined, to assess "Externalizing Behaviors" (Ketelaar et al., 2017): "Oppositional Defiant Disorder" scale (8 items, e.g., "blame others when making mistakes") and the "Conduct Disorder" scale (10 items, e.g. "Is physically cruel to people"). We calculated the grand mean of the scores that the caregivers gave on these items from the two scales and used this mean score as the indicator of the broadband externalizing behaviors.

Social competence

To assess social competence, the Chinese version of the Strengths and Difficulties Questionnaire (SDQ; Lai et al., 2010) was employed. The Chinese SDQ consists of 5 subscales with 25 items, screening for (young) children's social, emotional, and behavioral symptoms. Caregivers of the participants were instructed to rate on how their child showed each symptom/behavior in the past two months on a 3-point scale (0 = not true,

Table 2. Psychometric properties of all study variables at each time point

	NO. Items	Range of Scores	McDonald's omega	DHH		TH	
				mean	SD	mean	SD
<i>Time1</i>							
Shame	4	0-2	0.76	0.62	0.47	0.57	0.43
Guilt	4	0-2	0.81	1.13	0.44	1.27	0.38
Pride	7	0-2	0.85	1.56	0.35	1.68	0.34
Social Competence	10	0-2	0.80	1.29	0.34	1.43	0.31
Internalizing Behaviors	25	0-3	0.88	0.74	0.32	0.85	0.14
Externalizing Behaviors	18	0-3	0.89	0.86	0.37	0.82	0.38
<i>Time2</i>							
Shame	4	0-2	0.74	0.68	0.46	0.66	0.45
Guilt	4	0-2	0.82	1.28	0.35	1.38	0.39
Pride	7	0-2	0.84	1.66	0.32	1.75	0.28
Social Competence	10	0-2	0.73	1.46	0.28	1.50	0.27
Internalizing Behaviors	25	0-3	0.91	0.88	0.14	0.84	0.14
Externalizing Behaviors	18	0-3	0.90	0.78	0.35	0.78	0.36

1 = somewhat true, and 2 = certainly true). A higher score indicates higher social competence of a child.

Following Ketelaar et al. (2017), in this study we used two subscales to assess children's "Social Competence": the "Peer Relation" scale (5 items, e.g. "Picked on or bullied by other children"), and the "Prosocial Behavior" scale (5 items, e.g. "Helpful if someone is hurt, upset or feeling ill"). Three items of the "Peer Relation" scale were reversely formulated and thus were reversely coded in the later analytic process. The grand mean of the scores that the caregivers gave on the items from the two scales were calculated and used as the indicator of children's social competence.

Table 2 provides the descriptive statistics of the measurements used in this study. McDonald Omega's revealed that the internal consistencies of the questionnaires used in the present study ranged from 0.76 to 0.89 at Time 1, and from 0.73 to 0.90 at Time 2, indicating satisfactory to good internal consistencies of the measurements.

Statistical analyses

Statistical analyses were conducted using R version 3.6.2 (R Core Team, 2021). Figures were made using the package "Ggplot2" (Wickham, 2009). Multi-level analysis (LMM) were conducted using the "lme4" package (Bates et al., 2015).

Linear Mixed Models (LMMs) were used to analyze the longitudinal data which had a two-level structure (i.e., two time points nested within participants). The stepwise method was applied to enter variables to the models. Simpler models with better fit indices were preferred over more complex models. When evaluating the fit indices, the preferred model showed lower deviance (i.e., smaller -2 Log likelihood [$-2LL$] values) in a likelihood ratio test (Wood et al., 2008). Both unstandardized (B) and standardized (Beta) estimates were calculated and reported. The standardized estimates are considered good indicators for the effect sizes of the predicting variables (Gelman & Hill, 2006; Lorah, 2018).

First, to examine the changes of shame, guilt, and pride across time in DHH and TH children, we started with an unconditional

means model that included only a fixed and a random intercept. Next, age was entered to the model, to examine whether and how the levels of moral emotions changed across the two times points. Thereafter, group (0 = TH, 1 = DHH) was added to the models to examine whether the TH and DHH children differed on the levels of moral emotions. Lastly, the interaction between age and group was added to examine if the developmental trends of the moral emotions varied across groups.

Second, to investigate the contribution of the three moral emotions to predicting the psychosocial functioning of DHH and TH preschoolers, first, a mean variable and a change variable were created for each moral emotion. The value of the mean variable was the mean score of children's score at time 1 and at time 2. The value of the change variable was computed by subtracting participants' score at time 1 from that of time 2. Specifically, these mean variables were created to examine the between-subject effects, which informed us to what extent the levels of participants' moral emotions contributed to predicting their psychosocial functioning over time; whereas the change variables were created to examine within-subject effects, which could inform us how participants' increase or decrease of moral emotions contributed to predicting their psychosocial functioning (Li et al., 2021).

After we created the mean and change variables of moral emotions, we started with the baseline model which included only a fixed and a random intercept. Next, we entered age and group as fixed factors to the model. The interaction of age and group were also tested. Thereafter, we entered the mean and change variables of shame, guilt, and pride step by step into the models. Lastly, we entered the interactions of group and the mean and change variables, to further examine if the effects varied across TH and DHH preschool children.

Missing data analyses

At time 1, caregivers of 259 children filled in all the questionnaires. However, due to the COVID-19 pandemic, the research team lost contact with some of these participants at the second wave of data collection. As a consequence, only 130 participants had data on

both time points. The attrition rate of this longitudinal data is thus 49%. LMMs were often considered robust in handling data with attrition (Twisk et al., 2013). Simulation studies suggested that when the attrition of longitudinal data was lower than 50%, the results can be considered as not significantly biased (Gustavson et al., 2012; Pan & Zhan, 2020).

Furthermore, children who dropped out did not differ from those who had two waves of data in most variables at time 1 (i.e., age, nonverbal IQ, socioeconomic status, gender distribution, shame, pride, and externalizing behaviors), except for showing higher levels of guilt, fewer internalizing behaviors, and lower social competence than those who stayed ($ts > 2.13$, $p < .017$). Notably, the LMMs used in this study are known to be robust in handling data with attrition, especially on the condition that the (overall) data is missing at random (a MAR condition) (Ibrahim & Molenberghs, 2009; Twisk et al., 2013). Accordingly, we performed Little's MCAR test to evaluate the missing patterns of missing values. At time 1, the data was missing completely at random $\chi^2 = 3671.87$, $df = 5643$, $p > 0.05$, and less than 2% missing values existed in the data of time 1. At time 2, less than 0.5% missing data existed among the available data, which was also randomly distributed: $\chi^2 = 1311.69$, $df = 1347$, $p > 0.05$. Therefore, listwise deletion was applied to the missing data at time 1, whereas LMMs accounted for the missing follow-up points at time 2 (Twisk et al., 2013).

Results

The development of shame, guilt, and pride

Table 3 shows the estimations of the fixed and random effects of the best-fitting models for predicting the longitudinal changes of the levels of shame, guilt, and pride.

Regarding the development of shame, adding the effect of age ($b = 0.003$, $\beta = 0.09$, $t = 2.01$, $p = 0.03$, 95% CI: [0.0001, 0.006]) improved the model fit to the largest extent, showing the lowest $-2LL$ value (408.7). Entering the effect of group did not improve the model fit. The best-fitting model showed that the levels of shame increased during preschool years among all children. Additionally, DHH and TH preschoolers did not differ in the level of shame (Figure 1).

Regarding the development of guilt, the model with the fixed effects of age ($b = 0.01$, $\beta = 0.26$, $t = 6.70$, $p < 0.001$, 95% CI: [0.006, 0.012]) and group ($b = -0.10$, $\beta = -0.10$, $t = -2.40$, $p = 0.017$, 95% CI: [-0.19, -0.02]) had the lowest $-2LL$ (327.9). The results suggested that the levels of guilt increased in both groups during preschool years, whereas DHH preschoolers expressed overall less guilt than TH peers (Figure 1).

As for the development of pride, the model with the fixed effects of age ($b = 0.005$, $\beta = 0.14$, $t = 4.21$, $p < 0.001$, 95% CI: [0.003, 0.007]) and group ($b = -0.09$, $\beta = -0.09$, $t = -2.35$, $p = 0.019$, 95% CI: [-0.16, -0.01]) improved the model fit to the largest extent: $-2LL$ (195.3). The results suggested that pride increased in both groups during preschool years, and DHH preschoolers expressed less pride than TH peers (Figure 1).

Longitudinal associations between moral emotions and psychosocial functioning

Table 4 shows the fixed and random effects of the best-fitting models for predicting the longitudinal changes of the psychosocial functioning of DHH and TH children.

Table 3. Fixed and random effects of the best models for predicting moral emotions over time

	Shame			Guilt			Pride		
	B (SE)	Beta (SE)	CI [low, high]	B (SE)	Beta (SE)	CI [low, high]	B (SE)	Beta (SE)	CI [low, high]
Fixed effects									
Intercept	0.44 (0.08)	0.61 (0.03)	[0.27, 0.61]	0.81 (0.10)	1.25 (0.02)	[0.65, 0.96]	1.43 (0.07)	1.65 (0.02)	[1.30, 1.56]
Age (linear)	0.003 (0.001)	0.09 (0.04)	[0.001, 0.006]	0.01 (0.001)	0.26 (0.04)	[0.006, 0.012]	0.005 (0.001)	0.14 (0.03)	[0.003, 0.007]
Group	-	-	-	-0.10 (0.04)	-0.10 (0.04)	[-0.19, -0.02]	-0.09 (0.04)	-0.09 (0.04)	[-0.16, -0.01]
Random effects									
Residual	0.08 (0.28)	0.08 (0.28)	[0.25, 0.32]	0.09 (0.29)	0.09 (0.29)	[0.26, 0.33]	0.06 (0.24)	0.06 (0.01)	[0.06, 0.24]
Intercept	0.12 (0.35)	0.13 (0.35)	[0.30, 0.40]	0.05 (0.23)	0.05 (0.23)	[0.17, 0.28]	0.05 (0.21)	0.05 (0.01)	[0.05, 0.21]

Note. B = Unstandardized/Raw estimates of fixed effects; Beta = Standardized Estimates of fixed effects; SE = standard error. CI = 95% confidence interval. Significant effects are marked using bolded font.

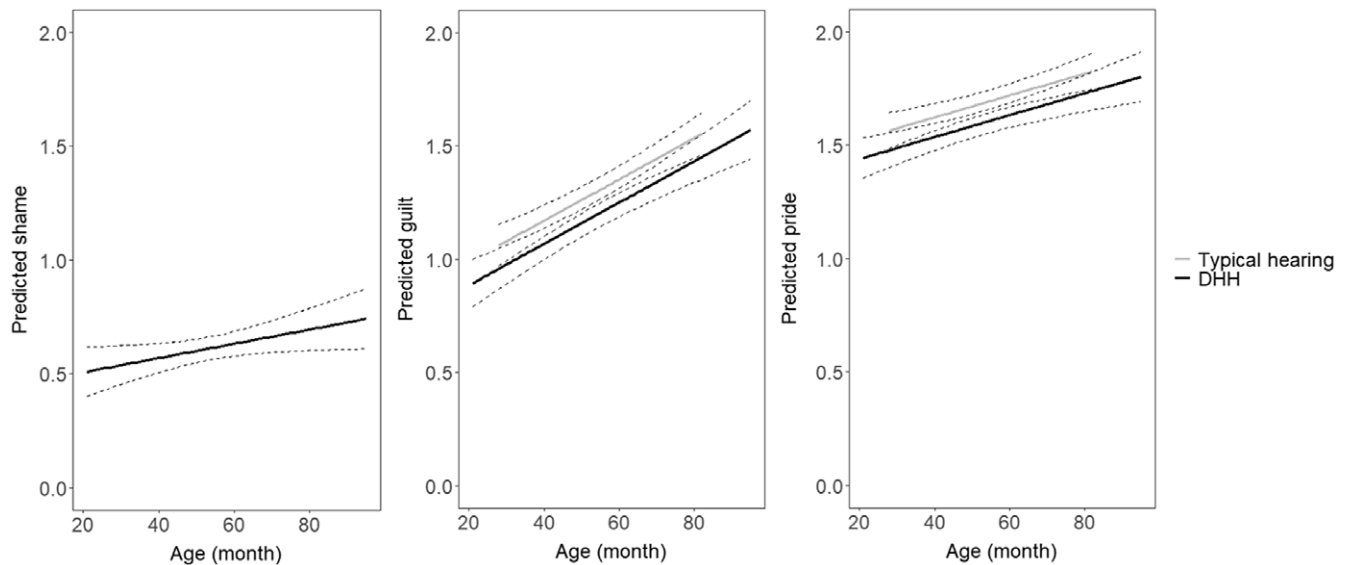


Figure 1. Longitudinal graphic representation of the predicted values based on the optimal fitting models: shame, guilt, and pride. Note: Gray solid lines represent the predicted mean values of typically hearing (TH) children, and black solid lines represent the predicted mean values of deaf and hard-of-hearing (DHH) children. Dotted lines represent the upper and lower ends of the 95% confidence interval. When there is no group difference, the solid line then represents the developmental pattern of both groups (i.e., the case of predicted shame).

For the development of internalizing behaviors, the best-fitting model that had the lowest $-2LL$ (-111.2) was with the fixed effects of group ($b = -0.07$, $\beta = -0.07$, $t = -3.10$, $p = 0.002$) and guilt-mean ($b = -0.09$, $\beta = -0.07$, $t = -3.19$, $p = 0.002$). This result indicated that internalizing problems remained stable over time. Overall, DHH preschoolers displayed lower levels of internalizing problems than TH peers; more guilt contributed to predicting fewer internalizing behaviors over time in both DHH and TH preschoolers.

As for the development of externalizing behaviors, the best-fitting model which had the lowest $-2LL$ (213.9) was with fixed effects of age ($b = -0.005$, $\beta = -0.15$, $t = -4.05$, $p < 0.001$), shame-mean ($b = 0.30$, $\beta = 0.25$, $t = 6.20$, $p < 0.001$), guilt-mean ($b = -0.12$, $\beta = -0.09$, $t = -2.23$, $p = 0.03$), and shame-change ($b = 0.16$, $\beta = 0.08$, $t = 2.50$, $p = 0.01$). This result showed that externalizing behaviors decreased over time in both DHH and TH preschoolers; more shame, less guilt, or an increase of shame, can contribute to predicting more externalizing behaviors over time in both TH and DHH preschoolers.

For the development of social competence, the best-fitting model which had the lowest $-2LL$ (10.4) included the fixed effects of age ($b = 0.004$, $\beta = 0.12$, $t = 4.23$, $p < 0.001$), group ($b = -0.16$, $\beta = -0.05$, $t = -1.77$, $p = 0.07$), shame-mean ($b = -0.17$, $\beta = -0.07$, $t = -2.40$, $p = 0.02$), guilt-mean ($b = 0.32$, $\beta = 0.24$, $t = 6.94$, $p < 0.001$), pride-mean ($b = 0.20$, $\beta = 0.13$, $t = 3.77$, $p < 0.001$), guilt-change ($b = 0.19$, $\beta = 0.10$, $t = 3.75$, $p < 0.001$), pride-change ($b = 0.23$, $\beta = 0.09$, $t = 3.60$, $p < 0.001$), and the interaction between group and shame-mean ($b = 0.18$, $\beta = 0.15$, $t = 2.48$, $p = 0.02$). The result indicated that children's social competence increased during preschool years; more guilt and more pride contributed to predicting better social competence over time in DHH and TH children; an increase of guilt and pride contributed to predicting better social competence among TH and DHH preschool children. As for the interaction effect of shame-mean and group, post-hoc analyses revealed that the level of shame was negatively associated with social competence over time in only TH preschoolers ($b = -0.17$, $\beta = -0.13$, $t = -3.35$, $p = 0.001$),

whereas the effect was not significant in DHH preschoolers ($b = 0.01$, $\beta = 0.01$, $t = 0.22$, $p = 0.82$).

Discussion

Moral emotions are crucial to children's social-emotional development. However, the development of moral emotions is under-studied for young children with hearing loss. This longitudinal research is amongst the first to investigate the development of shame, guilt, pride, and their associations with psychosocial functioning in DHH preschoolers, based on parent evaluations. Overall, our findings of guilt and pride are in line with the literature, whereas there were some unexpected findings of shame. First, as expected, DHH children exhibited lower levels of guilt and pride than TH children, and the two groups did not differ in the pace of development of guilt and pride, which increased over time in all children. Furthermore, as expected, the manifestations of guilt and pride were associated with better development of psychosocial functioning in all preschool children. Regarding shame, although the literature showed less manifestation of shame in DHH children than in TH children, we did not find any group difference. Whereas prior studies indicated that shame remained stable in early childhood (Li et al., 2021; Ross, 2017; Sette et al., 2019), we found an increase of shame over time in both DHH and TH preschoolers. In addition, although shame was negatively associated with children's social competence, this association was found in only TH children. Below we discuss our findings in detail.

Firstly, our study contributes supporting evidence for the socially adaptive role of guilt and pride in fostering children's psychosocial development (e.g., Broekhof et al., 2018; Ketelaar et al., 2015). Importantly, our findings highlight that guilt and pride held equal significance for TH and DHH children regarding their psychosocial functioning. However, our study also confirmed previous findings that DHH children may encounter greater challenges in developing these moral emotions. Taken together, our findings underscore the importance of creating an inclusive environment for DHH children that supports their development of moral emotions.

Table 4. Fixed and random effects of the best predicting models for children's psychosocial functioning over time

	Social Competence				Internalizing Behaviors				Externalizing Behaviors			
	B (SE)	CI [low, high]	Beta (SE)	CI [low, high]	B (SE)	CI [low, high]	Beta (SE)	CI [low, high]	B (SE)	CI [low, high]	Beta (SE)	CI [low, high]
<i>Fixed effects</i>												
Intercept	0.60 (0.10)	[0.36, 0.76]	1.41 (0.15)	[1.38, 1.44]	0.97 (0.04)	[0.89, 1.05]	0.82 (0.01)	[0.80, 0.84]	1.07 (0.09)	[0.89, 1.26]	0.82 (0.02)	[0.78, 0.86]
Age (linear)	0.004 (0.001)	[0.002, 0.006]	0.12 (0.03)	[0.06, 0.17]	-	-	-	-	-0.005 (0.001)	[-0.007, -0.002]	-0.15 (0.04)	[-0.22, -0.08]
Group	-0.16 (0.05)	[-0.27, -0.05]	-0.05 (0.03)	[-0.11, 0.05]	-0.07 (0.02)	[-0.10, -0.02]	-0.07 (0.02)	[-0.11, -0.02]	-	-	-	-
Shame-mean	-0.17 (0.05)	[-0.27, -0.07]	-0.07 (0.03)	[-0.13, -0.02]	-	-	-	-	0.30 (0.05)	[0.20, 0.39]	0.25 (0.04)	[0.17, 0.32]
Guilt-mean	0.32 (0.05)	[0.23, 0.41]	0.24 (0.03)	[0.17, 0.31]	-0.09 (0.03)	[-0.16, -0.04]	-0.07 (0.02)	[-0.11, -0.03]	-0.12 (0.05)	[-0.23, -0.01]	-0.09 (0.04)	[-0.17, -0.01]
Pride-mean	0.20 (0.05)	[0.10, 0.31]	0.13 (0.03)	[0.06, 0.19]	-	-	-	-	-	-	-	-
Shame-change	-	-	-	-	-	-	-	-	0.16 (0.07)	[0.04, 0.29]	0.08 (0.03)	[0.02, 0.14]
Guilt-change	0.19 (0.05)	[0.09, 0.28]	0.10 (0.03)	[0.04, 0.14]	-	-	-	-	-	-	-	-
Pride-change	0.23 (0.06)	[0.10, 0.35]	0.09 (0.03)	[0.04, 0.14]	-	-	-	-	-	-	-	-
Group * Shame-mean	0.18 (0.07)	[0.04, 0.32]	0.15 (0.06)	[0.03, 0.26]	-	-	-	-	-	-	-	-
<i>Random effects</i>												
Residual	0.04 (0.19)	[0.17, 0.23]	0.05 (0.22)	[0.20, 0.25]	0.04 (0.20)	[0.19, 0.22]	0.04 (0.20)	[0.19, 0.22]	0.06 (0.23)	[0.21, 0.27]	0.06 (0.23)	[0.21, 0.27]
Intercept	0.03 (0.17)	[0.14, 0.24]	0.02 (0.13)	[0.07, 0.17]	0.001 (0.001)	[0.001, 0.005]	0.001 (0.001)	[0.001, 0.005]	0.06 (0.24)	[0.20, 0.28]	0.06 (0.24)	[0.20, 0.28]

Note. B = Unstandardized/Raw estimates of fixed effects; Beta = Standardized Estimates of fixed effects; SE = standard error. CI = 95% confidence interval; Significant effects are marked using bolded font.

Secondly, prior studies suggested that DHH children exhibited less shame than their TH peers (Broekhof et al., 2020; Ketelaar et al., 2015) and that shame remained relatively stable in early childhood (Li et al., 2021; Ongley & Malti, 2014). However, our study found similar levels of shame in DHH and TH children, with shame increasing over time in both groups. This seems to indicate a more prominent development of shame in our sample. It is important to note that our sample consists of Chinese children, whereas the abovementioned studies on children's development of moral emotions were conducted in Western societies. In many Western cultures, shame is considered as detrimental to an individual's self-image (e.g., Gruenewald et al., 2004; Tracy & Robins, 2004). However, in typical East-Asian cultures including the Chinese culture, shame is considered to serve an adaptive function in certain contexts, including inducing self-reflection and keeping one's behaviors aligning with the social norms (e.g., Bagozzi et al., 2003; Heine, 2002; Wang et al., 2020). Collectivistic cultural values in East Asia more strongly prioritize group values over personal desires and interests (Hofstede, 1980; Triandis, 1993), hence potentially leading individuals to experience higher social pressure or motivation to feel shame for inappropriate social behaviors, as compared to Western individuals (Stadter & Jun, 2020; Tracy et al., 2007). Moreover, parents in East-Asian societies often use shaming as a parenting strategy to regulate children's behaviors. This could contribute to a high proneness to shame in East-Asian children at a young age (Tsai, 2007). The relatively more positive view on shame in East-Asian cultures might explain the increasing trend of shame observed in our sample. Noteworthy, our findings suggest that Chinese DHH preschoolers might have learned this cultural norm to a similar extent as their TH peers, thus showing no difference in the level or the developmental trend of shame from their TH peers. Future research could further examine these assumptions by conducting comparative studies across different cultures.

Thirdly, another unexpected finding regarding shame is that more manifestations of shame contributed to lower levels of social competence in TH preschoolers, whereas no such association was found in DHH preschoolers. Although feeling shame at an appropriate level can help children regulate their behaviors, experiencing it frequently and intensively may disrupt and jeopardize their interpersonal interactions, because a high propensity to feel shame typically implies that the ashamed individual encounters obstacles in fitting into the social world and exhibits low social adaptability (Ferguson et al., 1999; Tracy & Robins, 2004). This negative impact could be more salient for TH children compared to DHH children, because TH children generally have more opportunities to participate in social interactions. In contrast, DHH children might have fewer opportunities for social interactions, and thus the influence of shame experience and manifestations might be less pronounced in shaping their social images or defining their social relationships (Calderon & Greenberg, 2011; Netten et al., 2015).

Limitations and future directions

The present study provided new insights into the early development of moral emotions among DHH preschool children and broadened our horizon by providing information on a non-Western (Eastern Asian) sample. Nonetheless, the limitations should be noted. Firstly, the attrition rate of our sample was higher than expected. As mentioned, whereas data with a 50% attrition rate are generally considered as acceptable for analysis, lower attrition rates, ideally below 30%, are preferable for LMM estimations (Gustavson et al., 2012; Pan & Zhan, 2020).

Although LMMs are recommended for handling data with attrition, it is important to acknowledge that biases in the estimation could still exist, as children who dropped out at the second time point differed from those who stayed in guilt, internalizing behaviors, and social competence. Conducting future replication studies with a lower attrition rate could provide insights into the potential impact of the data loss on the study outcomes. Second, we solely relied on parent questionnaires as the measurement tool. This may elevate the risk of common method bias (Podsakoff et al., 2003). Future studies could apply a multi-method/multi-informant design, for example using behavioral tasks, field observations, or neuroscientific approaches, to deepen our understanding of young children's moral development. Examining the extent to which parent reports correspond to children's actual behaviors could also help us understand how to reliably measure moral emotions among young children. Third, our sample comprised DHH preschoolers who utilized hearing intervention devices and were receiving early intervention at a rehabilitation center (CRRCHSI) in Beijing. Although the average socioeconomic status of our sample (e.g., the parental education level, annual household income) was comparable to the national average level of China (Akimov et al., 2021), it is important to recognize that our sample may not represent the entire population of Chinese DHH preschoolers due to China's vast geographic and socioeconomic diversity. Thus, caution is warranted when generalizing our findings to other groups of DHH children. Future studies are recommended to use larger samples involving participants recruited in different regions, to improve their external validity. Especially, the majority of the DHH children in this study had severe-to-profound hearing loss and received a CI. More attention shall be paid to children with mild-to-moderate hearing loss, and those who do not receive a CI, as the needs of these children are even less understood and may encounter more problems in accessing the social world.

Conclusion

This longitudinal study revealed that, similar to TH children, moral emotions play an equally crucial role in influencing the psychosocial development of DHH children. However, consistent with previous research, our findings indicate that DHH children face greater challenges in developing moral emotions, particularly guilt and pride, which play an adaptive role in fostering positive psychosocial development. These challenges were already present in the preschool age and persistent over time. This underscores the importance of establishing an inclusive social learning environment where DHH children can receive the same level of support as their TH peers for developing their moral emotions. Additionally, our study suggests that culture could influence children's experiences and development of shame. Future research should adopt a more nuanced approach to explore the potential impact of culture and its interaction with children's hearing status in shaping their development of moral emotions.

Data availability statement. The data that support the findings of this research are openly available in DataverseNL (<https://dataverse.nl/>) at <https://doi.org/10.34894/F3ABDW>.

(The dataset and associated information used in the current study will be shared publicly on the archiving platform "DataverseNL," once the manuscript is accepted. According to the regulations of the Leiden University, materials and raw/processed data associated with an accepted paper will have to be archived and publicly shared along with the final manuscript within one month after publication).

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Author contribution. Zijian Li: Funding acquisition, Investigation, Data collection, Formal analysis, Writing Original Draft, Review & Editing; Boya Li: Review & Editing, Supervision, Project administration, Formal analysis; Yung-Ting Tsou: Formal analysis, Review & Editing, Supervision; Liyan Wang: Investigation/Data collection; Wei Liang: Investigation/Data collection; Carolien Rieffe: Conceptualization, Supervision, Project administration, Review & Editing, Funding acquisition.

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Competing interests. None.

Ethical standards. Formal approvals of this research were acquired from both the Ethical Committee of Leiden University, and the China Rehabilitation Research Center.

Participant consent statement. Signed paper-form consent, or online digital consent, were acquired from the caregivers of the participants.

Pre-registration. This research was pre-registered on the Open Science Framework (OSF), with a slightly different title (due to revision):

“The development of shame, guilt, pride and their associations with social-emotional functioning in Chinese preschool children with and without hearing loss”

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