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The interplay between parenting and environmental sensitivity in the prediction of children's externalizing and internalizing behaviors during COVID-19

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Abstract

The interplay of parenting and environmental sensitivity on children's behavioral adjustment during, and immediately after, the COVID-19 lockdown restrictions was investigated in two longitudinal studies involving Italian preschoolers (Study 1, $N = 72$; 43% girls, $M_{\text{years}} = 3.82(1.38)$) and primary school children (Study 2, $N = 94$; 55% girls, $M_{\text{years}} = 9.08(0.56)$). Data were collected before and during the first-wave lockdown (Studies 1 and 2) and one month later (Study 1). Parental stress and parent–child closeness were measured. Markers of environmental sensitivity in children were temperamental fearfulness and Sensory Processing Sensitivity. Results showed little change in externalizing and internalizing behaviors over time, but differences emerged when considering parenting and children's environmental sensitivity. In preschoolers, greater parenting stress was related to a stronger increase in internalizing and externalizing behaviors, with children high in fearful temperament showing a more marked decrease in externalizing behaviors when parenting stress was low. In school-aged children, parent–child closeness emerged as a protective factor for internalizing and externalizing behaviors during COVID-19, with children high in Sensory Processing Sensitivity showing a marked decrease in internalizing behaviors when closeness was high. Implications for developmental theory and practice in times of pandemic are discussed.

Keywords: COVID-19; environmental sensitivity; externalizing behaviors; internalizing behaviors; parenting

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At the beginning of 2020, the World Health Organization declared the status of an international health emergency after the first clusters of people infected by coronavirus disease were reported in China (WHO, 2020). In February 2020, Italy was the second most affected country in the world after China, and it is currently one of European countries with the highest death toll due to COVID-19 (Perico et al., 2020). Starting from March 2020, a series of drastic measures for transmission containment was prompted involving general population restrictions, such as orders to stay at home and work from home, closure of commercial activities, and school lockdown. These measures reduced infection and mortality rates, but because of the potential risks for mental and physical health and economy (Alwan, 2020), they were relaxed during the summer of 2020 until a second wave of COVID-19 started hitting Europe and the USA in September 2020. It has been estimated that the rapid spread of COVID-19 cases across the world has led to more than 1 million deaths in 2020 (Alwan, 2020).

To quantify the impact of this pandemic and of its associated complex array of factors on children's mental health, several online surveys have been conducted which contributed to drawing attention from governments, institutions, and clinicians to the psychological needs of children and adolescents (e.g., see (Bentenuto et al., 2020; Dellagiulia et al., 2020; Duan et al., 2020; Francisco et al., 2020; Loades et al., 2020; Yeasmin et al., 2020; Zhou et al., 2020)). Most of these studies agree that the COVID-19 pandemic and associated lockdown increased the risk of anxiety, depressive symptoms, sleep problems and externalizing behaviors, but there are also some mixed findings. For example, an increase in sleep problems in children has not been reported among all investigated samples (Lecuelle et al., 2020). Similarly, Zreik et al. (2020) found that only a minority of children was more at risk for maladjustment due to the pandemic, and Spinelli, Lionetti, Setti, et al. (2020) reported that emotion regulation competences in children during the lockdown were within normative ranges. Interestingly, qualitative studies also showed that children and adolescents were able to find positive aspects in the forced quarantine experience (e.g., Fioretti et al., 2020), and other empirical work reported a decrease in internalizing behaviors over time (Zaccaria et al., 2020).

Taken together, the findings reviewed above suggest that we might need to consider other variables, beyond the COVID-19

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situation itself, as candidate moderators of the quality of children's adjustment and wellbeing during the pandemic. With the current paper, we add to this line of research by focusing on the role of parenting during the lockdown and on its interaction with children's individual differences in sensitivity to the environment. In doing so, we assume the Environmental Sensitivity perspective (Pluess, 2015) as a theoretical framework of our analysis. By integrating theories on the individual-environment interplay, this framework allows to consider the interactive role of individual and environmental variables in the study of children's adjustment during the pandemic. In line with recent COVID-19 contributions targeting both parents and their children (see Bornstein, 2020; Moscardino et al., 2021; Patrick et al., 2020; Spinelli, Lionetti, Pastore, et al., 2020; Spinelli, Lionetti, Setti, et al., 2020), we propose that parenting, operationalized as parental levels of stress in the dyadic relationship and parent-child emotional closeness during the lockdown, are important factors that may shed light on the mechanisms involved in children's adjustment during the pandemic. Importantly, studies conducted during the COVID-19 outbreak reported that parent-child closeness was negatively influenced by levels of parenting stress (Chung et al., 2020), suggesting that when the parent perceives her/his parental role as more challenging, the warmth, closeness and emotional openness in the parent-child relationship can also decrease. This might, in turn, potentially impact on children's adjustment. By investigating parenting stress and parental perception of parent-child closeness in two different samples, we were able to consider both positive and negative aspects of the family environment while also limiting the number of questionnaires administered to participants in a challenging historical period. In addition to the role of the environment, because children vary in their susceptibility to environmental influences (Belsky & Pluess, 2009; Lionetti, Aron, et al., 2019; Slagt et al., 2018), we investigated whether parenting influenced children's adjustment during the pandemic more strongly in highly sensitive children compared to less sensitive ones. That is, some children might be more vulnerable when experiencing a highly distressed parent, but also benefit more from a parent who is able to show affection and an empathic understanding of children's emotions in unpredictable times. To this end, we conducted two separate longitudinal studies in Italy involving preschoolers (Study 1) and school-age children (Study 2), who were assessed before the COVID-19 outbreak, during the first-wave lockdown (Studies 1 and Study 2), and after the end of the lockdown (Study 1). This allowed us to overcome limitations of other COVID-19 related research, which mostly relied on a cross-sectional design, focused on child samples with a wide age range (e.g., parents of children younger than 18 years), and almost uniquely considered negative parenting aspects such as stress and anxiety. Given that the pandemic and related restrictive measures will likely persist for several months, the identification of variables that moderate children's adjustment in times of this global public health emergency may have important implications for identifying those children and families who are more in need of support.

Parenting and children's mental health during the COVID-19 lockdown

Restriction measures (hereafter referred to as lockdown measures) during the first wave of the COVID-19 outbreak imposed dramatic and unexpected changes in families' living conditions. Daily activities and routines that contribute to a sense of stability and security in everyday life were disrupted, with important risks for mental

health (Benner & Mistry, 2020; Bornstein, 2020). Indeed, studies conducted with adults evidenced high levels of psychological distress, which has been previously identified in response to natural disasters (Brooks et al., 2020; Hawryluck et al., 2004). A large-scale study involving adults reported that women living with minors in the home suffered the highest levels of anxiety and depression during the outbreak (Bruno et al., 2021). Psychological distress is likely to impair parents' ability to look after their offspring, causing a possible exacerbation of the detrimental impact of the pandemic on children. Due to the heightened sense of instability, the increased amount of time family members spend at home, and the reduced opportunities for children to experience other social environments, it is reasonable to suppose that the COVID-19 pandemic has amplified the influence of parenting and the household environment on children.

In support of this view, empirical data suggest that across different countries, the lockdown had a tandem effect on parents and children (Patrick et al., 2020; Spinelli, Lionetti, Pastore, et al., 2020), with an increase in parents' mental health problems occurring together with decreasing behavioral health among children (Patrick et al., 2020). For example, an increase in parental stress served as a key risk factor for children's emotional and behavioral adjustment in response to the health emergency (Russell et al., 2020; Spinelli, Lionetti, Pastore, et al., 2020), irrespective of other COVID related variables (e.g., living in a risk area for contagion, or knowing other persons who contracted the virus; Spinelli, Lionetti, Pastore, et al., 2020). Importantly, higher levels of parental stress have also been reported to negatively impact on parent-child closeness (Chung et al., 2020; Russell et al., 2020), an aspect that has been advocated as a candidate protective factor for children's adjustment to the pandemic. Yet, emerging evidence suggests that some children benefitted from the greater amount of time spent in their home environment, supporting the view that for some families, the lockdown associated with COVID-19 has also been an opportunity to experience deeper and stronger emotional connections (Fioretti et al., 2020; Zaccaria et al., 2020). Prompt supportive responses from parents might have generated a series of positive cascade effects (Masten & Motti-Stefanidi, 2020), or at least protected children from experiencing high levels of emotional stress.

The role of children's individual differences

Although parenting is one of the strongest predictors of child development, abundant research indicates that some children are more prone to experiencing maladjustment when exposed to adversities, while others are resilient when confronted with negative events due to their inherited temperamental characteristics (Masten, 2014). This suggests that some children might have been more vulnerable to the psychological impact of the restriction measures that took place during COVID-19. For example, the impact of hurricane Sandy in 2012 on US school-aged children varied as a function of children's temperament assessed at age 3 years. Specifically, higher levels of hurricane-related stress predicted the severity of depressive symptoms only among children with high levels of temperamental sadness, and elevated levels of anxiety symptoms were observed only among children high in temperamental fearfulness (Kopala-Sibley et al., 2016). However, across a series of investigations (Gilissen et al., 2008; Groeneveld et al., 2012; Kochanska et al., 2007), temperamental fearfulness has also been found to moderate the impact of the environment *for better and for worse*, with children scoring high in fear being more susceptible to the influence of both positive and negative

environments. These results, paired with findings suggesting the presence of an association between infant fearfulness and other susceptibility factors like the s/s genotype of the 5-HTTLPR (see (Auerbach et al., 2001), and with evidence that stressful events during pregnancy predict both children's fearfulness (Bergman et al., 2007) and differential susceptibility (Hartman et al., 2018), indicate that temperamental fear might capture an increased susceptibility to environmental quality.

At a phenotypic level, an individual trait extensively considered in recent empirical studies as a moderator of the impact of the environment is *Sensory Processing Sensitivity* (for reviews see Aron et al., 2012, and Greven et al., 2019). Highly sensitive children scoring high in Sensory Processing Sensitivity have been described as characterized by a reactive – rather than proactive – approach to stimuli, by a more cautious approach in response to novelty, and by a stronger emotional response to events (Lionetti, Aron, et al., 2019; Pluess et al., 2018), which confer these children an increased susceptibility to the environment (Slagt et al., 2018). Even though highly sensitive individuals tend to report more negative affect (for a meta-analysis, see (Lionetti, Pastore, et al., 2019), in line with the Differential Susceptibility model (Belsky & Pluess, 2009), they have also been found to be particularly sensitive to positive environmental experiences, such as intervention programs (de Villiers et al., 2018; Nocentini et al., 2018; Pluess & Boniwell, 2015) and positive parenting (Lionetti, Aron, et al., 2019; Slagt et al., 2018). Of interest, the trait of Sensory Processing Sensitivity presents similarities with temperamental fearfulness, capturing infants' tendency to be slow in approaching new environments and stimuli, and to startle in response to sudden changes (Gartstein & Rothbart, 2003). Hence, both traits might capture individual differences in response to the environment during COVID-19.

The environmental sensitivity meta-framework in the context of COVID-19 lockdown

Across the last 20 years, models of person – environment interplay (Aron & Aron, 1997; Belsky & Pluess, 2009; Boyce & Ellis, 2005) summarized and integrated in the *Environmental Sensitivity* meta-framework (Pluess, 2015), provided empirical evidence that traits conferring an increased susceptibility to negative environments also potentially allow to benefit more from positive environmental stimuli. According to recent empirical investigations, around 25%–30% of individuals (Lionetti et al., 2018; Pluess et al., 2018) are highly sensitive to environmental stimuli (Greven et al., 2019). Based on empirical evidence and theoretical reasoning, it is possible that for highly sensitive children, the impact of the quality of the family environment during the lockdown was stronger than for less sensitive ones. Importantly, this increased susceptibility might not only have exposed highly sensitive children to a higher risk of psychological problems during the pandemic, especially in the context of an overwhelmed family environment, but it might also have allowed them to benefit more from a positive home environment. If moderators of the impact of the pandemic on outcomes are not considered, we risk to miss important information that can allow us to understand why, and for whom, a specific condition can represent a risk factor, and why other individuals seem to be more resilient in the face of adversities or even to benefit more from improved living conditions.

Overview of the current studies

The growing literature on the adjustment of children during the COVID-19 pandemic has provided important insights by

highlighting the need to move beyond the physical and economic impact of the pandemic to address its influence on children's mental health. However, several issues deserve further investigation. First, whilst there is some evidence concerning child and parental levels of wellbeing during the pandemic, knowledge about the interplay of parenting and children's individual traits is still lacking. Second, most available studies are based on a cross-sectional design, lacking comparative baseline data that would help to disentangle pandemic effects from pre-existing behavioral difficulties. Third, the COVID-19 literature has largely focused on older children from around middle-childhood and onwards, with limited findings on preschoolers, or involved groups of (parents of) children generally described as under the age of 18, limiting our understanding of the specificities which characterize particular age periods. Finally, the majority of studies so far has considered negative aspects of the environment, such as parental stress and anxiety, neglecting the potentially protective role of positive family resources in children's wellbeing.

The current paper aims to tackle these issues by including baseline measures of children's behavioral problems and considering both family and individual-level variables that might independently and interactively explain children's adjustment during the first wave of the COVID-19 pandemic, framing our investigation in terms of Environmental Sensitivity. In particular, we refer to the strict lockdown in Italy which was imposed by a presidential decree from March 9th to May 3rd, 2020. To this end, we considered data from two separate longitudinal studies that were ongoing before the first wave of the pandemic in Italy, and that were targeting children of two different age groups for whom measures of behavioral problems and individual levels of sensitivity were available before the pandemic. Study 1 involved a sample of preschoolers whose data on child temperament and on adjustment were available when children were aged 4 and 24 months, respectively. These children were followed up one month after the beginning of the national lockdown (April 2020), and one month after the end of the lockdown (June 2020). Study 2 comprised a sample of children attending the second and third years of primary school, who were assessed two months before the lockdown (January 2020) and one month after the national lockdown started (April 2020). In each of these studies, different parenting variables were considered in relation to the specific age period of the participants. An overview of the studies is provided in Table 1.

In Study 1, we focused on a negative parenting variable, that is, the degree of stress perceived by parents in the parent–child relationship during the lockdown. Parental stress has been defined as a reaction arising from the experience of a series of demands perceived as inconsistent with expectations, or when parents perceive that they cannot meet these demands (Holly et al., 2019). Given that preschoolers are still highly dependent on their caregivers for the structuring of their daily routines and developmental functions, parents of young children might be exposed to particularly high levels of stressful emotions in their role. This might have been especially true during the lockdown related to COVID-19, when parents had to manage multiple tasks at the same time in the family environment (as, for example, supporting children in structuring their time while also having to work from home). With regard to child characteristics, we focused on the temperamental trait of fear as a marker of children's Environmental Sensitivity. We decided to consider temperamental fear as a sensitivity marker in our sample of preschool children for several reasons. First, we had the unique opportunity to rely on data concerning a candidate susceptibility marker in infancy.

Table 1. Overview of Study 1 and Study 2 timelines

	Before COVID-19 outbreak		During wave one COVID-19 outbreak	
	T0	T1	T2 During lockdown	T3 After lockdown
Study 1	4 months of age, sensitivity to the environment (temperamental fear)	Age 2, externalizing and internalizing behaviors	Parenting and externalizing and internalizing behaviors	Parenting and externalizing and internalizing behaviors
Study 2		Age 8–10, sensitivity to the environment (HSC) and externalizing and internalizing behaviors	Parenting and externalizing and internalizing behaviors during lockdown	

Second, this trait is especially relevant in response to potentially traumatic events (Parsons & Ressler, 2013), and has been previously found to moderate the impact of the environment – including disasters – on outcomes (Belsky & Pluess, 2009; Gilissen et al., 2007; Kopala-Sibley et al., 2016). Third, currently available measures for directly investigating sensitivity in preschoolers are extensively time-consuming (e.g., see Lionetti, Aron, et al., 2019) or less validated compared to those specifically developed for school aged children (Boterberg & Warreyn, 2016). Fourth, temperamental fearfulness is less negatively biased than other markers of sensitivity to the environment (such as difficult temperament), and it has been reported to moderately correlate with observed sensitivity (Lionetti, Aron, et al., 2019). Finally, in infancy it captures a “pause-to-check” approach which is coherent with the reactive attitude and behavioral inhibition of highly sensitive individuals, as defined by the Sensory Processing Sensitivity construct (see Greven et al., 2019; Lionetti, Aron et al., 2019; Slagt et al., 2018).

In Study 2, we focused on a positive parenting variable as an indicator of environmental quality, namely parent–child closeness, defined as parents’ perception of warmth and open communication with the child (Driscoll & Pianta, 2011), previously reported as a protective factor in relation to other traumatic events, as exposure to war (e.g., Eltanamly et al., 2021). Parent–child closeness might be particularly suitable for investigating the quality of the relationship in an age range in which there is often a more direct and open communication about events, including negative ones, and related emotions, including those related to COVID-19. Children’s Environmental Sensitivity was measured with the Highly Sensitive Child scale (Pluess et al., 2018), a phenotypic marker of sensitivity that has repeatedly been shown to moderate the impact of the environment and has been extensively validated among school aged children (Nocentini et al., 2018; Slagt et al., 2018). In both studies, parental reports of externalizing and internalizing behaviors were available as measures of children’s adjustment. These aspects tackle important domains of children’s socio-emotional and behavioral development, and have been the focus of prior COVID-19-related research.

We hypothesized that, across both samples, negative and positive aspects of parenting (perceived stress and closeness in the parent–child relationship) would be predictive of children’s individual variations in their behaviors during the pandemic. We further anticipated that the impact of the parenting environment would be stronger for children with high (vs. low) levels of sensitivity to the environment due to their unique characteristics. Importantly, the availability of two studies allowed us to test the same person-environment interaction model in two independent samples that differed in age.

Study 1

Study 1 involved a sample of preschool children. Fearful temperament was investigated when children were four months old as part of an ongoing study concerning socio-emotional development from infancy to preschool-age (T0). Children’s externalizing and internalizing behaviors were assessed when children were 24 months old (T1), during the second month of the national COVID-19 lockdown (April 2020, T2), and one month after the end of the national lockdown (June 2020, T3). In April and June 2020, perceived parenting stress in the parent–child relationship was also measured.

We hypothesized that children’s externalizing and internalizing behaviors would increase from T1 to T2 when children were exposed to high levels of stress in the parent–child relationship, whereas low levels of stress in the parent–child relationship would be a protective factor; hence, we assumed that parenting quality would moderate the degree of change in children’s externalizing and internalizing behaviors during the lockdown and shortly after. In addition, we hypothesized that the role of parenting in children’s changes in behavioral adjustment would be more evident for children scoring high (vs. low) in fearful temperament. In other words, we considered fearful temperament as a marker of individual differences in sensitivity to the environment. Specifically, we expected children high in fear to show the highest increase (compared to their low sensitive peers) in externalizing and internalizing behaviors when exposed to high levels of stress in the parent–child relationship, but also to show a decrease in these behaviors when exposed to low levels of parenting stress. We hypothesized this trend to be stable one month after the end of the lockdown (T3).

Method

Participants

Parents and children were part of an ongoing project aimed at investigating the interplay between parental and individual variables on children’s socio-emotional development. The sample originally included 83 Italian children and their primary caregivers, recruited through flyers distributed in hospitals after babies were born. When families were contacted again during the lockdown, 11 did not answer after two phone calls; thus, 72 children (43% girls) were involved in the current study. At the assessment during the lockdown (T2), children’s mean age was 3.82 years ($SD = 1.38$, range = 2–6), whereas mothers’ mean age was 34.53 years ($SD = 4.96$, range = 20–44). Maternal educational level was distributed as follows: 4 % had completed elementary school, 35% had completed high school, and 62% had a University degree. Concerning maternal occupation, 16% were housewives, and the rest was employed.

Procedure

Children's fearful temperament was investigated with the Infant Behavior Questionnaire-Revised (IBQ-R; Gartstein & Rothbart, 2003; Rothbart, 1981) completed by mothers at infant age 4 months (T0). When children were two years old (T1), during the lockdown (T2), and one month after the end of the lockdown (T3), mothers reported on their children's externalizing and internalizing behaviors using the Italian version of the Child Behavior Checklist for Ages 1½–5 (CBCL) (Achenbach & Rescorla, 2000). During the lockdown (T2) and one month after the end of the lockdown (T3), mothers reported on perceived stress in the parent-child relationship via the Parent Child Dysfunctional Interaction scale (PCDI) of the Parenting Stress Index (PSI) (Abidin, 1995).

Measures

Child fearful temperament

To investigate children's temperament, mothers completed the Italian version of the IBQ-R (Gartstein & Rothbart, 2003; Rothbart, 1981). The measure has been extensively validated across multiple contexts and countries, including Italy (Aureli et al., 2015), and the scale capturing fear has been repeatedly reported as candidate moderator of children's sensitivity to environmental influences (Belsky & Pluess, 2009; Kopala-Sibley et al., 2016). The fear scale includes 10 items rated on a 7-point Likert-scale, with a higher average score reflecting higher levels of baby's startle or distress to sudden changes in stimulation, novel physical objects or social stimuli. In the current sample, Cronbach's alpha of the fear scale was .90.

Child externalizing and internalizing behaviors

The externalizing and internalizing scales of the CBCL 1½–5 (Achenbach & Rescorla, 2000) completed by the mother were used to evaluate children's emotional behavioral adjustment. Items are rated on a 3-point Likert scale ranging from 0 = never to 2 = often. In the current sample, at T1, Cronbach's alpha values were .87 for the externalizing scale and .79 for the internalizing scale. At T2, they were .90 for the externalizing scale and 0.81 for the internalizing scale. At T3, they were 0.92 for the externalizing scale and 0.82 for the internalizing scale.

Parenting

Mothers completed the PCDI scale of the Italian version of the PSI-SF (Abidin, 1995). The scale includes 15 items measuring the extent to which parents feel unsatisfied with their children and their interactions with them, rated on a 5-point Likert scale ranging from 0 = strongly disagree to 4 = strongly agree. Higher scores indicate higher perceived stress in the parent child relationship. Parents were asked to complete the questionnaire considering the relationship with the child during the last week. In the current-sample, Cronbach's alpha for the PCDI scale was 0.98 at T2, and 0.83 at T3.

Data analysis

A series of mixed-models were run and compared considering externalizing and internalizing behaviors as dependent variables. More specifically, the following models were tested and compared: (1) Model 1, including time (T1 and T2) as predictor of children's behaviors; (2) Model 2, including time, parenting stress, and fearful temperament as main effects; (3) Model 3, adding the interaction term time X parenting stress to investigate if parenting moderated

children's changes in behaviors from before to during the lockdown; (4) Model 4, adding the interaction term time X parenting stress X fearful temperament to explore whether changes in child adjustment were moderated by the interplay between parenting stress and fearful temperament. Because children varied in regard to the age at assessment, we included age in all models as a control variable.

To compare models of children's adjustment during the lockdown (T1 and T2) and select the model receiving the most support, we used Akaike weights ranging from 0 to 1 and representing the probability of a model to predict new data conditional upon the considered models (Wagenmakers & Farrell, 2004). For descriptive purposes, we also reported the explained variance using conditional R^2 , suited for mixed effects regression models. Then, in order to explore if the pattern of findings identified during the lockdown was comparable to the one observed one month after its end (T3), we reran the model(s) that received the most support considering all time points. A quality check was performed for the best selected model, including investigation of residuals versus fit plots (to detect non-linearity, unequal error variances, and outliers), spread-location plots (to check homoscedasticity, that is, if residuals are spread equally along the range of predictors), and normality of residuals and random effects (Fox, 2015).

In order to follow-up significant interaction effects, we plotted model expected values for individuals scoring high and low in fearful temperament considering the top 30% and bottom 30% of the temperamental trait distribution (Pluess et al., 2018), and computed the degree of change considering the difference between expected values (Δ).

For regression analyses, we used the package lme4 in R (Bates et al., 2007). Packages ggplot2 and sjPlot in R were used to depict and graphically explore interaction effects (Wickham et al., 2019).

Results

Descriptive statistics

Descriptive statistics and bivariate associations are reported in Table 2. Parenting stress during the lockdown (T2) and 1 month after the end of the lockdown (T3) was moderately to strongly associated with both internalizing and externalizing behaviors. Children's fearful temperament was positively associated with CBCL scores, with generally higher effect sizes for the association with internalizing behaviors ($r = .30$ at T1, $r = .13$ at T2, and $r = .33$ at T3) compared to externalizing behaviors (ranging from $r = .18$ during the lockdown, T2, to $r = .18$ one month after its end, T3).

Regression models: children's adjustment during the lockdown

For the investigation of children's adjustment during the lockdown, data on temperament and parenting stress were available for 72 participants up to T2; of these, 65 subjects also had data on behavioral problems. At T3, data were available from 57 subjects.

Externalizing behaviors

Akaike weights provided support for Model 4, that is, the model including the three-way interaction time X parenting stress X fearful temperament as predictor. Indeed, for models 1–3, R^2 values were overall stable; the highest increase in explained variance was identified for Model 4. Results of the model comparison are reported in Table 3, with Akaike weights and explained

Table 2. Descriptive statistics of Study 1 variables: means, associated standard deviations, and Pearson's *r* bivariate correlations

	M (SD)	1	2	3	4	5	6	7	8	9	10
Sex	57% female	–	–	–	–	–	–	–	–	–	–
Age (years) at (T2)	3.82 (1.38)	–.33	–	–	–	–	–	–	–	–	–
Fearful temperament T0	1.61 (0.90)	.11	–.19	–	–	–	–	–	–	–	–
Parenting stress T2	18.99 (6.52)	–.12	–.23	.12	–	–	–	–	–	–	–
Parenting stress T3	18.40 (5.69)	.12	–.18	.28	.64	–	–	–	–	–	–
Internalizing behaviors T1	0.17 (0.13)	.06	–.01	.30	.08	.43	–	–	–	–	–
Internalizing behaviors T2	0.19 (0.15)	.19	–.07	.13	.35	.56	.45	–	–	–	–
Internalizing behaviors T3	0.18 (0.16)	.04	–.17	.33	.35	.64	.61	.66	–	–	–
Externalizing behaviors T1	0.48 (0.68)	.18	–.13	.16	.29	.48	.46	.66	.46	–	–
Externalizing behaviors T2	0.48 (0.67)	.06	–.08	.18	.40	.73	.60	.60	.66	.62	–
Externalizing behaviors T3	0.48 (0.34)	.02	–.19	.14	.28	.68	.53	.53	.79	.60	.76

Note. For fearful temperament and parenting stress at T2, data were available for $n = 72$ participants (5% r critical value = $|.23|$). For behavioral problems at T2, data were available for $n = 65$ subjects (5% r critical value = $|.24|$). At T3, data were available for $n = 57$ subjects (5% r critical value = $|.26|$).

Table 3. Study 1, Akaike weights and conditional R^2 for compared models

	Akaike weights		Akaike weights	
	Ext. behaviors	R2	Int. behaviors	R2
Model 1, Time	.00	.61	.02	.45
Model 2, Time, parenting stress and fearful temperament	.26	.62	.19	.47
Model 3, Time X Parenting Stress	.30	.62	.65	.50
Model 4, Time X Parenting stress X Fearful Temperament	.44	.67	.15	.51

Note. $N = 72$, number of observations = 137.

variance, while parameters of all investigated models can be found in the supplementary material file. The three-way interaction was significant, with $B = .01$, $SE = .004$, $p = .006$, suggesting that the quality of the parent–child relationship moderated children's adjustment during the COVID-19 lockdown, conditional upon individual differences in temperament. More specifically (Figure 1, panel A), at low levels of parenting stress (1 SD below the mean), children scoring low in fearful temperament (bottom 30% of the fear distribution) showed a decrease in externalizing behaviors equal to $\Delta = -.09$, whereas for children scoring high in this trait, the decrease was almost twice and equal to $B = -.15$. At medium levels of parenting stress, both groups showed no change in externalizing behaviors from T1 to T2 ($\Delta = .01$ and $\Delta = -.02$ for children scoring low and high in fear, respectively), whereas at high levels of parenting stress both groups showed, to a comparable extent, an increase ($\Delta = .11$ in both groups). Hence, preschoolers with high fearful temperament were somewhat more sensitive to the positive effect of low parental stress in the household, while not necessarily being more at risk than their peers at high levels of parenting stress. The quality check suggested no violations of common assumptions; plots are reported in the supplementary material file.

Internalizing behaviors

Akaike weights provided support for Model 3, that is, for the two-way interaction model with time X parenting stress (Table 3). Again, an increase in explained variance emerged only when the interaction term was added. The two-way interaction was

significant, with $B = .01$, $SE = .002$, $p = .02$, suggesting that the quality of the parent–child relationship moderated children's adjustment during the lockdown (for all other model parameters see the supplementary material file). As depicted in Figure 1, panel B, the higher the parenting stress, the higher the increase in children's internalizing behaviors from T1 to T2. More specifically, the degree of change from T1 to T2 was $\Delta = -.03$ for low values of parenting stress (1 SD below the mean), $\Delta = .02$ for medium values of parenting stress, and $\Delta = .08$ for high levels of parenting stress.

Diagnostics on models and missing values

In the supplementary material section, we provide findings from model diagnostics and an estimation of the stability of findings with and without imputed data based on 4,000 replicates. Diagnostic statistics suggest no violation of the tested regression models, and according to results with imputed data findings are overall stable with and without imputation.

Regression models: follow-up analyses at T3, 1 month after the lockdown

For the follow-up investigation of the interaction between parenting and children's sensitivity one month after the end of the lockdown, data were available for a subsample of $n = 57$ parents and children. Results were overall stable. Parents who provided information at T2, but not at T3 scored higher in terms of parenting stress (21.35 vs. 18.41), but the difference was not large (Cohen's $d = .46$, $[-.13, 1.04]$). Again, a significant three-way interaction emerged, with time X parenting stress X fearful

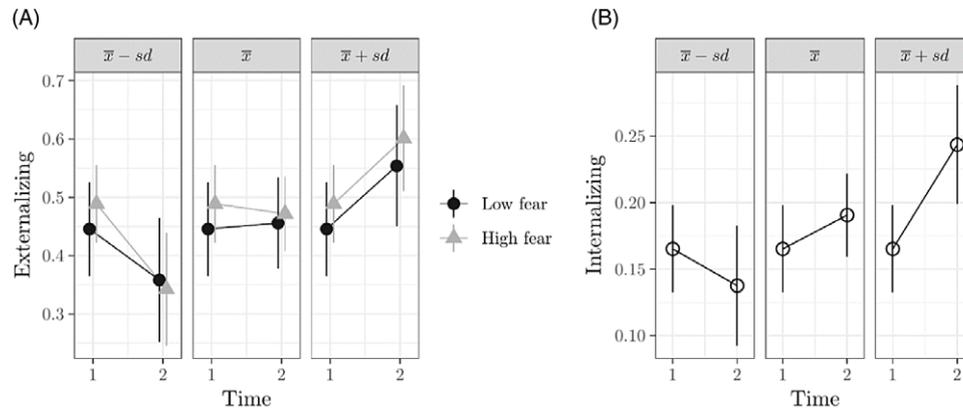


Figure 1. Graphical representation of estimated parameters derived from Model 4 for externalizing behaviors, and Model 3 for internalizing behaviors. Time 1 refers to pre COVID-19 levels of behavioral problems; Time 2 to COVID-19 lockdown, with behavioral problems conditional on parenting stress levels. As depicted in panel A, at low levels of parenting stress ($\bar{x} - 1\text{SD}$, left box), the decrease in children's externalizing behaviors was $\Delta = -.15$ for children high in temperamental fear, and $\Delta = -.09$ for those scoring low. At medium levels of parenting stress (\bar{x} , central box), both groups showed no significant change in externalizing behaviors ($\Delta = .01$ and $\Delta = -.02$ for children scoring low and high in fear, respectively), and at high levels of parenting stress ($\bar{x} + 1\text{SD}$, right box) the two groups showed a comparable increase ($\Delta = .11$ in both groups). As depicted in panel B, the higher the parenting stress, the higher the increase in children's internalizing behaviors. Changes from T1 to T2 were $\Delta = -.03$ for low values of parenting stress, $\Delta = .02$ for medium values of parenting stress, and $\Delta = .08$ for high levels of parenting stress.

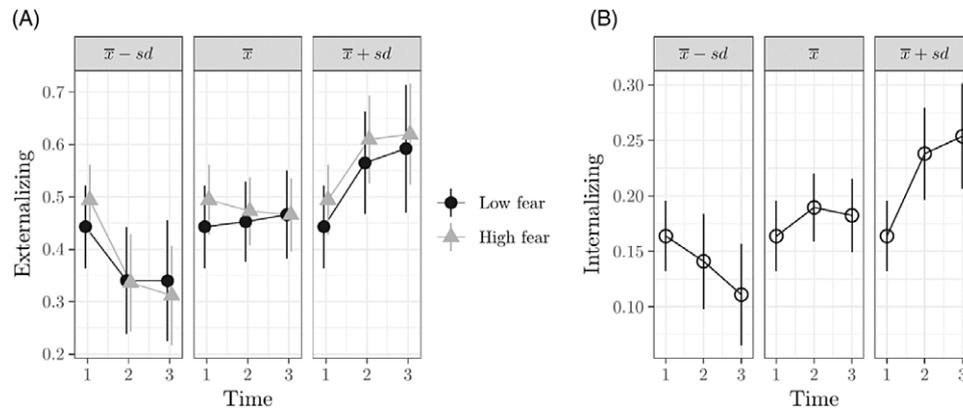


Figure 2. Graphical representation of findings from Model 4 for externalizing behaviors and Model 3 for internalizing behaviors at T1 (with levels of behavioral problems before COVID-19 pandemic), T2 (with behavioral problems conditional on parenting stress during the lockdown) and T3 (with behavioral problems conditional on parenting stress one month after the end of the lockdown). The pattern of findings reported in Figure 1 remained overall stable, with a further decrease in externalizing problems for children high in fearful temperament when parenting stress was low.

temperament predicting externalizing behaviors ($B = .013$, $SE = .005$, $p = .006$ for T2 and $B = .014$, $SE = .006$, $p = .017$ for T3, see also Figure 2). Moreover, we recorded a significant two-way interaction of time X parenting in predicting internalizing behaviors ($B = .006$, $SE = .002$, $p = .010$ for T2 and $B = .010$, $SE = .003$, $p = .001$ for T3, see also Figure 3). The quality check suggested no violation of common regression assumptions (see the supplementary material file).

Discussion

According to Study 1, preschoolers' changes in internalizing and externalizing behaviors were not driven by the time variable alone, potentially capturing the lockdown experience; rather, they were better understood when considering the main and interactive role played by parenting and children's temperamental fearfulness. More specifically, in relation to externalizing behaviors, children low and high in the temperamental trait of fear showed an overall continuity of behavioral problems when parenting stress was at an

average level, and an increase in behavioral problems when their parents reported higher levels of parenting stress, with a slightly stronger effect of parenting for children high in fearful temperament. Of relevance, children high in fear were found to show lower levels of externalizing behaviors when exposed to less parenting stress, but they were not more at risk than their peers when parenting stress was high. Hence, preschoolers who were highly susceptible to environmental influences showed a benefit from an increase of time spent with their parents during the lockdown when the environment was characterized by low levels of stress in the parent-child relationship. With regard to internalizing behaviors, parenting alone better predicted variations from before to during the lockdown. More specifically, when parenting stress was at an average level, internalizing behaviors overall did not change; a very small decrease was present when parenting stress was low and, importantly, for high levels of parenting stress, children showed a marked increase in internalizing difficulties from T1 to T2.

The pattern of findings identified during the lockdown was highly comparable to that identified one month after the

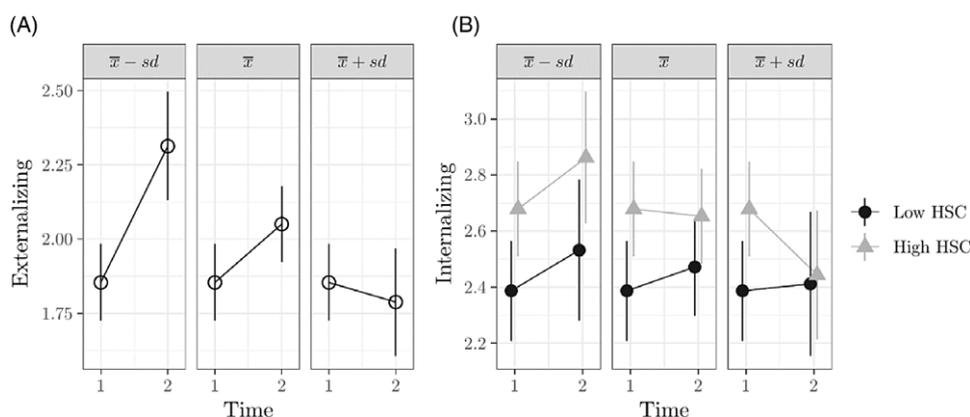


Figure 3. Graphical representation of findings from Model 3 for Externalizing behaviors and Model 4 for Internalizing behaviors before (behavioral problems at T1) and during the lockdown (behavioral problems conditional on closeness in the parent–child relationship during T2). As depicted in panel A, at low levels of parental closeness ($x - 1$ SD, left box), the increase from T1 to T2 was $B = .15$ for low sensitive children (low HSC), and slightly higher, $B = .18$, for highly sensitive children (high HSC). At medium values of parental closeness (x , central box), internalizing behavioral problems overall did not change for any group ($\Delta = .08$ for low sensitive children and $\Delta = -.03$ for high sensitive children). Importantly, at high levels of parental closeness ($x + 1$ SD, right box), highly sensitive children showed a reduction of internalizing behaviors during the lockdown ($\Delta = -.23$), while levels of internalizing behavioral problems did not change for low sensitive children ($\Delta = .02$). Pertaining to panel B, changes from T1 to T2 were $\Delta = .46$ for low values of parental closeness (1 SD below the mean), $\Delta = .20$ for medium values of parental closeness, whereas behavioral problems overall did not change when parental closeness was high, $\Delta = -.07$.

end of the lockdown, providing further statistical support to the investigated interaction models. Thus, rather than the lockdown itself, the whole COVID-19 situation with its restrictions and changes in families' daily routines, still present at our follow-up, might have played a crucial role. To summarize, based on the current findings, parenting moderated changes in children's externalizing and internalizing behaviors during COVID-19, with high parenting stress being a risk factor for an increase of internalizing and externalizing behaviors in all children, and low levels of stress being protective against externalizing behaviors specifically among children high in fearful temperament.

Study 2

Study 2 explored children's changes in externalizing and internalizing behaviors during COVID-19 involving a sample of second and third graders. Children's externalizing and internalizing behaviors were investigated two months before the COVID-19 emergency (January 2020; T1) and one month after the lockdown (T2). During the first assessment, children's sensitivity to stimuli, as captured by the individual trait of Environmental Sensitivity investigated through the Highly Sensitive Child scale (Pluess et al., 2018), was also assessed. Parenting was measured in terms of the degree of closeness in the parent–child relationship during the lockdown (T2). We hypothesized that children's externalizing and internalizing behaviors would increase from T1 to T2 when children were exposed to low levels of parent–child closeness in the household. Correspondingly, we hypothesized that high closeness in the parent–child relationship during the lockdown would be a protective factor for children's adjustment. In addition, we hypothesized that the impact of parenting on children's changes in externalizing and internalizing behaviors would be particularly strong for children high in the individual trait of Environmental Sensitivity. In other words, we expected highly sensitive children to show the highest increase in externalizing and internalizing behaviors when exposed to low levels of parent–child closeness, but also that their externalizing and internalizing behaviors would be lower than those of their less sensitive peers when exposed to high levels of closeness.

Method

Participants

Italian mothers of 94 children (55% female; $M_{\text{age}} = 9.08$ years, $SD = 0.56$, range = 8–10 years) attending primary schools in Italy provided information before and during the COVID-19 lockdown. They were part of an ongoing study involving a convenience sample of families recruited through personal contacts with schools, and originally aimed at validating measures of Environmental Sensitivity in primary school children. Mothers' mean age was 40.65 years ($SD = 4.79$, range 29–52), and their educational level was distributed as follows: 82% had completed high school, 18% had a university degree. One mother did not provide information in this regard. Concerning maternal occupation, 3% of mothers were housewives, 97% were employed.

Procedure

Before the COVID-19 outbreak, in January 2020 (T1), mothers reported on their children's Environmental Sensitivity using the parent-report version of the HSC scale (Pluess et al., 2018; Slagt et al., 2018), and on externalizing and internalizing behaviors using a short version of the Paediatric Symptoms Checklist (PSC (Gardner et al., 1999). In April 2020 (T2), during the COVID-19 lockdown, parents reported on perceived closeness in the parent–child relationship using the Closeness scale of the Parent–Child Relationship Scale (Pianta, 1992), and again on externalizing and internalizing behaviors via the PSC.

Measures

Environmental sensitivity

Mothers completed the 12-item HSC scale (Pluess et al., 2018), parent-report version (Slagt et al., 2018). The measure has been extensively validated across multiple contexts and countries, including Italy (Nocentini et al., 2018), and the mean score across the 12 items is considered as a measure of individual differences in sensitivity to the environment, including parenting (Slagt et al., 2018). Items are coded on a 7-point Likert-scale, with a higher average score reflecting higher sensitivity levels. Items included

Table 4. Descriptive statistics of study variables: means, associated SDs, and Pearson's *r* bivariate correlations

	M (SD)	1	2	3	4	5	6	7
Sex	48% male	–	–	–	–	–	–	–
Age (years)	9.08(0.56)	–.08	–	–	–	–	–	–
Sensitivity	4.64(0.98)	.04	–.08	–	–	–	–	–
Parent–child closeness T2	3.98(0.43)	.08	–.16	.02	–	–	–	–
Internalizing behaviors T1	2.56(0.91)	–.18	–.02	.11	–.21	–	–	–
Internalizing behaviors T2	2.59(0.79)	–.03	–.06	.24	–.24	.52	–	–
Externalizing behaviors T1	2.20(0.68)	–.24	–.10	.23	–.27	.35	.38	–
Externalizing behaviors T2	2.44(0.67)	–.20	–.12	.11	–.38	.34	.45	.76

Note. *N* = 94. Values of correlations equal or greater than $|\cdot17|$ were significant at $p < .05$.

in the HSC scale assess a variety of responses to environmental stimuli, for example, finding it unpleasant to have a lot going on around (e.g., “My child finds it unpleasant to have a lot going on at once”), appreciating nice smells and music (e.g., “Some music can make my child really happy”), and being prone to unpleasant feelings caused by strong sensory stimuli, such as bright lights or loud sounds (e.g., “Loud noises make my child uncomfortable”). In the current-sample, Cronbach's alpha was 0.80.

Child externalizing and internalizing behaviors

For the assessment of children's adjustment, a brief version of the PSC was used (Gardner et al., 1999), with three items for externalizing behaviors (“fights with others”; “does not listen to rules”; “teases others”) and three items for internalizing behaviors (“feels sad, unhappy”; “is down on him/herself”; “worries a lot”) translated into Italian following standard translation-backtranslation procedures. Items were rated on a 6-point Likert scale and were averaged to obtain a composite score. In the current sample, Cronbach's alpha values were satisfactory (considering the low number of items) and equal to 0.63 for the externalizing domain, and to 0.69 for the internalizing domain at T1, and to 0.72 for the externalizing domain and to 0.68 for the internalizing domain at T2.

Parenting

The quality of the parent–child relationship was investigated using the Closeness subscale of the Parent–child Relationship Scale (Pianta, 1992), Italian version (Settanni et al., 2015). This scale includes eight items capturing the degree of closeness and positive aspects of the relationship (e.g., “I share an affectionate, warm relationship with my child”; “If upset, my child seeks comfort in me”). Items are rated on a 5-point Likert scale ranging from 1 = does not apply to 5 = definitely applies. Parents were specifically asked to complete the questionnaire by considering the relationship with the child during the last week. In the current sample, Cronbach's alpha for the summary score was 0.79, similar to previous research (Settanni et al., 2015).

Data analysis

A series of mixed-models were run and compared as detailed in the data analysis section of Study 1.

Results

Descriptive statistics

Descriptive statistics and bivariate associations are reported in Table 4. Parent–child closeness during the pandemic was negatively associated with both internalizing and externalizing behaviors, with the strongest association being with externalizing behaviors at T2 ($r = .38$). Children's sensitivity was positively associated with externalizing and internalizing behaviors, with associations overall low in effect size (ranging from $r = .11$ for sensitivity and internalizing behaviors at T1 and externalizing behaviors at T2, to 0.23 for externalizing behaviors at T1, and to 0.24 for internalizing behaviors at T2).

Regression models: children's adjustment during the lockdown

Externalizing behaviors

The model receiving more support compared to the others was the one including the interaction between time and parent–child closeness. Akaike weights and associated explained variance are reported in Table 4. Regression parameters of all tested models are available in the supplementary material. The two-way interaction time X parent–child closeness was significant, with $B = -.37$, $SE = .13$, $p = .005$, suggesting that the quality of the parent–child relationship moderated the impact of time on externalizing behaviors. As depicted in Figure 3, the lower parent–child closeness, the higher the increase in children's externalizing behaviors from T1 to T2. More specifically, from T1 to T2 the degree of change was $\Delta = .46$ for low values of parent–child closeness (1 SD below the mean), $\Delta = .20$ for medium values of parent–child closeness, whereas behavioral problems overall did not change when closeness was high, $\Delta = -.07$. The quality check (see Supplementary File) suggested that there were no violations of regression assumptions.

Internalizing behaviors

Akaike weights provided support for the three-way interaction model with time X parent–child closeness X Environmental Sensitivity as predictor (Table 5). The three-way interaction was significant, with $B = -.37$, $SE = .17$, $p = .035$. Regression parameters of all models tested are in the supplementary file. As depicted in Figure 3, panel B, highly sensitive children (scoring in the top 30% of the sensitivity distribution) showed overall higher levels

Table 5. Study 2, Akaike weights and conditional R^2 for compared models

	Ext. behaviors	R2	Int. behaviors	R2
Model 1, Time	.00	.66	.00	.51
Model 2, Parent-child closeness and environmental sensitivity	.02	.67	.37	.52
Model 3, Time X parent-child closeness	.95	.69	.00	.51
Model 4, Time X parent-child closeness X environmental sensitivity	.03	.69	.63	.55

Note. $N = 94$, number of observations = 188.

of internalizing behaviors both at T1 and T2 compared to low sensitive children. However, the degree of change in internalizing behaviors from T1 to T2 was moderated by parent-child closeness. More specifically, for low levels of parent-child closeness (1 SD below the mean), the increase from T1 to T2 was $\Delta = .15$ for low sensitive children, and slightly higher, $\Delta = .18$, for highly sensitive children. At medium values of parent-child closeness, for both low and high sensitive children, internalizing behaviors overall did not change much ($\Delta = .08$, for low sensitive children and $\Delta = -.03$ for high sensitive children). Importantly, at high levels of parent-child closeness, highly sensitive children showed a reduction of internalizing behaviors reported during the lockdown ($\Delta = -.23$), while levels of internalizing behaviors remained unchanged for low sensitive children ($\Delta = .02$). The quality check (see the supplementary file) suggested that there were no violations of regression assumptions.

Discussion

In Study 2, children attending primary school showed an increase in externalizing behaviors when the quality of the parent-child relationship was low in closeness. Conversely, high levels of parent-child closeness, that is, a relationship characterized by a sense of security in the parent-child bond and by the opportunity of sharing thoughts, feelings, and physical affection was protective against an increase in externalizing behaviors. A positive family climate might have allowed children to reprocess feelings of confusion, unpredictability, and change during the lockdown, helping them to better regulate their emotions and behaviors. Concerning the internalizing domain, results suggested that high levels of parent-child closeness were particularly protective for highly sensitive children who showed, both before and during the lockdown, overall slightly higher levels of internalizing behaviors. Of note, while low levels of parent-child closeness were associated with a small increase in internalizing behaviors during the lockdown in both low and – to a greater extent – highly sensitive children, a specific protective effect emerged at high levels of parent-child closeness for highly sensitive children. Specifically, these children, who were more at risk of internalizing problems at T1, showed lower levels of internalizing behaviors compared to pre-COVID-19 in the presence of a highly supportive parent-child relationship experienced during the lockdown, reaching the same levels of internalizing behaviors identified in low sensitive children.

General discussion

The COVID-19 global pandemic represents a large-scale socio-historical event that caused a series of significant changes and challenges at the health, educational, and relationship levels. Studies conducted to investigate the impact of the pandemic on children's

adjustment found children to be at risk of more emotional and behavioral problems, but also revealed substantial variability in terms of adjustment outcomes. If we broaden our lens of observation to other potentially dramatic events, such as hurricanes and natural disasters, we can see that this relatively mixed pattern of findings resembles the results of other studies within the disaster literature (Acierno et al., 2006; Bonanno et al., 2010; Boscarino et al., 2013; Galea et al., 2007; Hammen, 2005; McLaughlin et al., 2009; North & Pfefferbaum, 2013; Pfefferbaum et al., 2014; Wang et al., 2013). Our study sought to shed light on specific variables that might have contributed to children's adjustment in times of COVID-19 beyond the pandemic itself. Specifically, we proposed to consider parenting quality and its interplay with children's sensitivity to the environment to better understand children's adjustment during the pandemic, investigating changes in levels of externalizing and internalizing behaviors during the strict lockdown that took place in Italy during the first wave of COVID-19. We tested this in a sample of preschoolers (Study 1, in which data were available before and during the lockdown, as well as one-month post-lockdown) and in children attending the second and third years of primary school (Study 2, in which data on adjustment were available before and during the outbreak of the pandemic).

Results across both samples converged on the notion that it was not time (hence, potentially, the lockdown experience) alone, but the quality of parenting during lockdown and its interaction with children's sensitivity to predict child adjustment during the pandemic. Importantly, although the effect sizes were overall modest (for a discussion on relatively low effect size in the developmental psychology literature, see also (Schäfer & Schwarz, 2019), findings were consistent across both studies, providing support for the relevance of considering aspects of the environment as well as children's individual traits when investigating children's adjustment to the COVID-19 situation. More specifically, parenting had a direct impact on changes in preschool children's internalizing behaviors and on school aged children's externalizing behaviors, suggesting that an environment less able to provide a sense of emotional security might increase those behaviors that are less frequently reported by parents from normative samples in the specific age range considered (i.e., externalizing behaviors are more often reported in the preschool years, while internalizing behaviors, except for separation anxiety, are more commonly observed from middle childhood, see Basten et al., 2016). Conversely, the interaction between parenting and children's sensitivity emerged as the most relevant predictor of preschoolers' levels of externalizing behaviors and school-aged children's internalizing difficulties, such that children high in sensitivity were more susceptible to parenting experienced during the lockdown compared to their low-sensitive peers. In particular, for highly sensitive preschoolers, being in a low-risk family

environment (i.e., low in parenting stress) was associated with a decrease in externalizing behaviors, with a vantage effect. Pertaining to school aged children, when reared in a positive environment during the lockdown (i.e., high in parent-child closeness), they showed decreased levels of internalizing behaviors, reaching the same levels of their less sensitive peers. When the environment was low in closeness, both low and high sensitive children increased their internalizing behaviors, although the impact of parenting was slightly higher for highly sensitive children compared to the less sensitive ones. These results suggest that an increase of positive quality time in the home environment was protective against potentially multiple stimuli characterizing the out-of-home social environment, which might be more disturbing and overwhelming for a sensitive child than not having to spend more time in a sensitive and supportive home environment. Also, findings converge with other empirical data showing that a positive family environment might indeed support highly sensitive children to learn adaptive strategies to regulate their emotions, hence decreasing the risk of internalizing thoughts (Lionetti *et al.*, 2021). This result is particularly relevant if we consider the higher risk of internalizing problems for highly sensitive individuals (Greven *et al.*, 2019; Liss *et al.*, 2008).

Interestingly, the interactive effect of parenting and children's sensitivity on externalizing behaviors in preschoolers and internalizing behaviors in school aged children is not an isolated finding. Indeed, a similar pattern has been identified in a study following up children from preschool years to middle childhood (Lionetti, Aron, *et al.*, 2019), and is in line with findings reporting a greater vulnerability to externalizing behaviors for highly sensitive infants and preschoolers (Belsky & Pluess, 2009; Bradley & Corwyn, 2008), and to internalizing behaviors for sensitive children, adults, and adolescents (for a meta-analysis see Lionetti, Pastore, *et al.*, 2019).

Of note, the pattern of findings was comparable (based on data from Study 1) after the end of the lockdown. This provides further statistical support to the investigated interaction model, with children high in temperamental fearfulness showing a further decrease in externalizing behaviors when parenting stress was low, possibly due to the continued lockdown effects, the unresolved state of the pandemic, interruptions to schooling and social interaction. Still, it has to be considered that parents completing the questionnaires both during and after the lockdown experienced levels of stress that were slightly lower than those of parents for whom information was available only during the lockdown. Thus, the detected levels of externalizing and internalizing behaviors after lockdown could have been higher if all parents had provided feedback across all time points. This represents an interesting question for future studies, since it is possible that more at-risk families are less represented in longitudinal studies during these challenging periods. However, this pattern could also reflect a stability of the interplay between parenting and child temperament on children's adjustment in this specific developmental phase.

Applied implications, limitations, and future directions

Overall, the results highlight that parents had a key role in terms of children's response during the COVID-19 outbreak, and this was especially true for children high in sensitivity. This finding, considered together with the results reporting that parents faced significant challenges and stress, underscore the importance of investing in parenthood and in related programs to support the wellbeing of the family environment if we want to counteract the risks of a pandemic emergency which appears to be still far from being

resolved. At the same time, our findings emphasize the relevance of considering both child sensitivity and the quality of the family environment for an accurate identification of at-risk children who are more likely to exceptionally benefit from low-risk and supportive environments in potentially challenging times.

These results must also be considered in light of limitations. First, the sample was ethnically and socioeconomically homogenous, therefore limiting the possibility of generalizing findings to other samples with diverse ethnocultural and socioeconomic backgrounds. Second, although we were able to rely on longitudinal data and the samples were narrow in terms of age range, the relatively small sample size has to be acknowledged. We adopted a model comparison approach and graphical exploration of findings for a more accurate analysis of results beyond statistically significant values only, performed quality checks on statistical findings, and built our hypotheses based on a strong theoretical background, but larger samples from multiple countries are required to generalize these research findings to other contexts and nations. By collecting data on behavioral problems before and after the pandemic, and with a relatively narrow time window (see Study T2 and T3, and Study 2), we tried to control for rapid changes that the pandemic has generated in terms of family life, routines, and sense of stability and predictability. However, the unprecedented and rapidly evolving nature of the COVID-19 pandemic requires attention and caution before inferring causal relationships between a novel environmental factor and a change in children's developmental pathways. Similarly, bidirectional associations between parental behaviors and feelings and children's behavioral problems across multiple time points could be considered in future longitudinal studies. Moreover, some methodological aspects, more generally related to research in the field of developmental psychopathology in times of COVID-19, must be considered. One is that the majority of studies conducted thus far and involving children has relied on parent-report measures. Albeit validated, these measures might not always objectively capture the quality of children's adjustment, being potentially influenced by parental perceptions. Another aspect that requires caution is that measures currently used to investigate parents and children's adjustment and children's development during the COVID-19 pandemic have mostly been validated under different circumstances, and therefore might not fully capture the adjustment in this extraordinary and unpredictable historical period. Finally, despite the relatively narrow time window for the multiple time-points of Study 2, the consistency of findings across Study 1 and Study 2, and the strong theoretical framework that informed the tested and investigated models, we cannot exclude that the pattern of findings might also be due to developmental aspects and time passing by, rather than being specific to COVID-19. Notwithstanding these limitations, we hope with our studies to have contributed to raise awareness about the need of considering a number of moderators at the environmental and individual level when investigating the impact of historical and societal events, such as COVID-19, on children's developmental pathways.

To conclude, findings from the current studies suggest that it was the complex interplay between individual and family variables to better predict variations in children's externalizing and internalizing behaviors. A primary caregiver who is able to effectively regulate his/her emotional reactions in challenging times and who is emotionally and physically equipped to provide a secure base represented an important buffering effect, with a stronger impact on highly sensitive children. Because quality of parenting plays a

substantial role in children's adjustment, especially during times of pandemic, and considering the specific patterns resulting from children's levels of sensitivity to the environment, we suggest that professionals might consider a multifaceted picture of environmental and individual factors to optimize intervention effects aimed at preventing or mitigating the impact of the pandemic on developing children and families' wellbeing.

Supplementary material. To view supplementary material for this article, please visit <https://doi.org/10.1017/S0954579421001309>

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Conflict of interests. The authors have no conflicts of interest to declare.

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