MIND, BRAIN, AND EDUCATION

"Why Can't I See My Friends and Family?": Children's Questions and Parental Explanations About Coronavirus

Amanda S. Haber[1], Sona C. Kumar[1], Hannah Puttre[1], Nermeen Dashoush[1], and Kathleen H. Corriveau[1]

ABSTRACT— Question-explanation exchanges in parent–child interactions foster children's early learning, especially when children are inquiring about unobservable scientific phenomena such as the novel coronavirus (COVID-19). As with other unobservable entities, children must rely on adults to acquire knowledge about COVID-19. Yet, we know very little about what children understand about COVID-19 or its consequences. In our study, we explored developmental changes in children's questions about COVID-19 and parents' explanations. Parents (n = 182) of children (aged 3–8) completed an online survey, which included demographic information, parents' explanations, and children's questions. Parents' explanations *referenced germs*, used *illness analogies*, and mentioned *mitigation strategies*. Most of children's COVID-related questions focused on the *consequences of COVID-19*. Whereas older children asked more about *death*, younger children asked about loss of *activities*. The findings advance our understanding of the impact of COVID-19 on parents and children.

Question-explanation exchanges in parent–child interactions play a critical role in fostering children's early learning (Butler, Ronfard, & Corriveau, 2020), especially when learning about unobservable scientific phenomena such as the novel coronavirus (COVID-19), responsible for the current global health crisis. According to the *World Health Organization* (WHO, 2021), as of October 2021, COVID-19 has impacted 219 countries, with over 235 million confirmed cases and 4.5 million confirmed deaths. According to the *United Nations Education Scientific and Cultural Organization* (UNESCO, 2021), the pandemic impacted over 1.15 billion learners worldwide in May 2020 (when data were collected). Because COVID-19 is not visible to the naked eye and because of the time delay between exposure and the onset of symptoms, this crisis presents a unique opportunity to explore how young children learn about unobservable scientific concepts such as COVID-19 through verbal information from trusted sources. Accordingly, we explored children's questions and parental explanations about COVID-19 to elucidate the process through which children develop theories about unobservable entities.

Children's Understanding of Abstract Scientific Concepts, Illness, and Death

Although children can learn many scientific concepts through first-hand experimentation, testimony from trusted sources is important when children are learning about unobservable scientific concepts such as germs (Canfield & Ganea, 2014; Harris & Corriveau, 2014; Harris & Koenig, 2006; Harris et al., 2018) or mechanisms underlying opaque causal processes such as electricity (Clegg, Cui, Harris, & Corriveau, 2019; Leech, Haber, Jalkh, & Corriveau, 2020). Because children cannot directly observe

[1]Wheelock College of Education and Human Development, Boston University

Address correspondence to Amanda S. Haber, Boston University, 621 Commonwealth Avenue, Boston, MA 02215; e-mail: haber317@bu.edu

such phenomena, they rely on testimony from adults for information (Campbell & Corriveau, 2018).

Some research positions adult testimony as a strategy by which children determine the existence of invisible entities. For example, because adults discuss them using similar language, young children (aged 4–8) express equal confidence in the existence of invisible scientific entities and visible entities, highlighting the role of testimony in shaping children's confidence in the existence of these concepts (Campbell & Corriveau, 2018; Harris, Pasquini, Duke, Asscher, & Pons, 2006; Shtulman, 2013). In addition to the testimony of others, children rely on their intuitive knowledge about germs and illness, particularly in regards to the role germs play in transmitting disease. Even so, testimony and cultural learning still shape how children understand contagions (Au et al., 2008). As children get older, their understanding and knowledge of illness increases, shifting from naïve theories (i.e., cold weather causes the common cold) toward theories involving contagion (Sigelman, 2012). Such shifts in children's understanding of the causal mechanisms are related to behavioral changes: both enhancing children's health-promoting behaviors (Au et al., 2008) and increasing their illness-avoidant behaviors (Blacker & Lobue, 2016).

Similarly, when learning about death, children's understanding develops between the ages of 4 and 6 from centering on behavior (e.g., sleeping) to centering on biology (e.g., heart has stopped; Slaughter, 2005). Although there is little work on the role of naturalistic parental testimony on children's conceptions of life and death, findings from experimental work indicates that children between ages 3 and 5 can be trained explicitly to understand the concept of life (Slaughter & Lyons, 2003). However, such concepts continue to develop throughout childhood (Giménez & Harris, 2005). Because children's understanding of germs, illness, and death are developing throughout early childhood, explanations from parents play a vital role in children's understanding of such abstract and unobservable concepts. In the following section, we highlight the potential content of such conversations.

Questions and Explanations Foster Children's Early Learning

Children often acquire knowledge through question-explanation-follow-up exchanges with others (Butler et al., 2020; Chouinard, 2007; Frazier, Gelman, & Wellman, 2009; Hickling & Wellman, 2001). By 5 years of age, children are able to construct questions aimed at acquiring specific content knowledge (Chouinard, 2007; Greif, Kemler Nelson, Keil, & Gutierrez, 2006; Mills, Legare, Bills, & Mejias, 2010; Mills, Legare, Grant, & Landrum, 2011). During the early years, children use questions to inquire about death (Issacs, 2000) and scientific concepts such as illness and germs (Ronfard, Zambrana, Hermansen, & Kelemen, 2018). Whereas children's fact-based ("what," "when", "who") questions can be answered with a simple response, causal ("why" and "how") questions (e.g., "why do you get COVID-19?") require a more complex explanation from adults (Callanan, Shrager, & Moore, 1995; Crowley et al., 2001). Findings from naturalistic parent–child conversations (Kurkul & Corriveau, 2018) and diary methodologies (Callanan & Jipson, 2001; Callanan & Oakes, 1992) indicate that question-explanation exchanges serve as a powerful mechanism for children's knowledge acquisition.

In the science domain, parents' explanations are fundamental to children's understanding specific concepts (Benjamin, Haden, & Wilkerson, 2010; Crowley et al., 2001; Fender & Crowley, 2007). For example, when parents and children engage in free play with science materials such as gears, children spent more time experimenting with the science activity when their parents encouraged them to explain what they were doing, rather than to explore (Willard et al., 2019). Similarly, parental explanations that included mechanistic language (language focusing on cause and effect) predicted their child's (aged 4–5) performance on a scientific task (Kurkul, Castine, Leech, & Corriveau, 2021; Leech et al., 2020). Thus, parent explanations play a critical role in children's understanding of scientific concepts.

The Current Study

To the best of our knowledge, little research has examined how children's questions and parental explanations about COVID-19 change throughout early childhood. Some work has invited teachers and parents to respond to children's hypothetical questions through written (Haber, Leech, Benton, Dashoush, & Corriveau, 2021) or verbal prompts (Mills et al., 2021). In recent work, Haber et al. (2021) utilized a survey methodology to understand how teachers think they should respond to children's science questions. Mills et al. (2021) used a *Prompted Explanation Task*, a controlled task where parents were asked to provide explanations to a set of questions (imagining their child had been the one asking the question). In the current study, we capitalize on the use of simulated questions and explanations by inviting parents of children between ages 3 and 8 years to complete an online survey about COVID-19 in May 2020. We asked two main research questions. First, to explore the *knowledge* children had access to; we explored parental explanations about COVID-19 when talking to their children. We focused on the method of the explanation (strategies parents used in their explanation) and the content of the explanation. We anticipated that parents' explanations would focus on the opaque process of disease *transmission* as well as behavioral changes associated with disease prevention (e.g., washing hands). Second, to explore the

process through which such knowledge was acquired, we focused on children's COVID-related questions, and potential developmental changes in question-asking behavior. We have emphasized the unobservable and abstract facets of the COVID-19 pandemic (e.g., germs lead to illness), but the pandemic has also given rise to observable consequences such as wearing masks or having to stay indoors. We predicted that children's questions would relate to both the unobservable and the observable consequences. However, because research shows that children's conceptions of death shift and mature between the ages of 4 and 6, we divided children into "younger" (3- to 5-year-old) and "older" (6- to 8-year-old) age groups (Slaughter, 2005). We predicted that older children might ask more questions associated with illness or death, whereas younger children might ask more questions about changes in their activities.

METHOD

Participants

The final sample included 182 parents in the United States (170 female; 10 males; 1 nonbinary; 1 unspecified). We recruited through social media and parent online forums. In addition, we sent the survey to educators in diverse (e.g., Title I) schools who shared the survey with parents in their district (consent was obtained through approval from Boston University Institutional Review Board). To investigate potential developmental difference based on child age, we recruited parents with children aged 3–8. The survey was open from May 1st to June 11th. Our final sample included data from parents of 38 3-year-olds, 30 4-year-olds, 37 5-year-olds, 30 6-year-olds, 24 7-year-olds, and 23 8-year-olds. Parents lived in 19 states. The majority (n = 154; 85%) of parents were in Massachusetts (n = 87), New York (n = 38), California (n = 15), and New Jersey (n = 14), states hit particularly hard by COVID-19 by May 2020. The racial distribution (reported by participants) of the sample was as follows: 155 identified as White, 8 as Asian, 6 as Latinx/Hispanic, 3 as African American, 2 as White Hispanic, 1 as Multiple Racial, 1 as Middle Eastern, 1 as Afro-Caribbean, as 5 identified as other. Finally, 39% of parents (n = 71) reported having an essential worker at home. We did not define the term essential worker for participants, recognizing that the term could vary across location and contexts. Instead, participants self-reported their status. In May 2020, the term essential worker was typically used to describe pandemic workers who interacted with the public in either medical, food, or service settings (individuals who did not work remotely). Parents were eligible to participate if they were at least 18 years old and had a child between age 3 and 8 years old.

Procedure and Materials

Participants completed three blocks (13 questions total) on Qualtrics software in a fixed order: (i) *demographic information*, (ii) *parents' explanations about COVID-19*, and (iii) *children's questions related to COVID-19*. Each block is described in more detail below.

Demographic Information

Parents reported their child's age, the race and gender of the reporting parent, country, and state of residence and whether there was an essential employee in the household.

Parents' Explanations about COVID-19

To explore parental explanations about COVID-19, parents were presented with the prompt, "Please share how, if at all, you explained the Coronavirus to your child," and invited to write in their response. Next, participants were asked: "Have you used any of the following to explain the science behind COVID-19 to your child? Please check all that apply." Parents were invited to indicate if they had used analogies, illustrations/drawings, pictures, fictional stories, videos, models, and to write in other strategies they might have used.

Children's Questions Related to COVID-19

To investigate children's questions about COVID-19, participants were presented with the prompt, "Please share, if at all, questions your child is asking related to COVID-19" and were asked to write in their response.

Coding

Parents' Explanations for COVID-19

Explanations were coded for the *method* of explanation and the *content*. We distinguish between the "method" and the "content" by considering the "method" to be the process that parents use to help children understand COVID-19 and by considering the "content" of the parental explanations to be more focused on the specific subject matter (see Table 1). The *method* of COVID-19 explanations was coded using four non-mutually-exclusive categories: (i) *illness analogy* (e.g., "it is a bad virus like the flu"), (ii) *referenced germs* (e.g., "these germs are more contagious than others"), (iii) *used third-party knowledge* such as a video or reading material (e.g., "we watched the Sesame Street episode about Corona"), and (iv) *general explanations*, which included any explanations that did not use one of the three strategies (e.g., "many people have been getting sick"). The *content* of COVID-19 explanations was coded using three non-mutually-exclusive categories: (i) *mentioned illness* (e.g., "it's a contagious illness going around that you"), (ii) *causing death* (e.g., "some people can die from it"), and (iii) *mitigation strategies* or behavioral

Table 1
Coding Scheme for Parents' Method of Explanation and the Content of the Explanation

Level	*Codes*	*Examples and subcodes*
Method of explanation	Illness analogy	"It is like a bad flu making people very sick."
	Referenced germs	"Explained that a lot of people have been getting sick and that we have to help out by staying home so we do not spread germs."
	Used third-party knowledge	"We watched the Sesame Street episode about Corona and watched a YouTube video recommended by our speech therapist about Corona."
	General explanations	"It can be very harmful to people especially older people."
Content of explanation	Mentioned illness	"It's an illness that can make people very sick."
	Causing death	"It was important to stay away from people because the virus could kill people."
	Mitigation strategies	*Social distancing* ("We talk about social distancing to keep people safe.")
		Handwashing ("We talk about why we need to wash our hands.")
		Wearing masks ("We wear masks to stop the spread of germs.")
		Loss of activities ("People are getting sick so it's not safe to go to stores or school.")

changes associated with disease prevention, which had four subcodes: *social distancing* (e.g., "we need to social distance and until it's safe to return back to everyday life"), *handwashing* (e.g., "it is important to wash our hands"), *wearing masks* (e.g., "we have to wear a mask, so we don't get sick"), and *loss of activities* (no school or seeing friends, e.g., "we won't go to school, so we don't spread germs").

Children's Questions Related to COVID-19

Children's questions related to COVID-19 were coded into two categories (see Table 2): *questions about COVID-19 itself* (e.g., "how did COVID-19 start?") and *questions about the consequences of COVID-19* (e.g., "when will I go back to school?").

Questions about COVID-19 itself were further separated into three mutually exclusive categories: (1) *pandemic onset* (e.g., "how did it COVID-19 stat?"), which were further categorized as causal (e.g., "why do people get COVID-19?") or fact-based questions (e.g., "who started it?"; (2) *pandemic conclusion*, including the length (e.g., "when will it end?") and vaccine development (e.g., "when will scientists find a cure?"); and (3) *disease symptoms* (e.g., "how long does it stay in your body?").

Questions about the consequences of COVID-19 were further categorized into five non-mutually-exclusive codes: (1) *death* (e.g., "will grandma die?"); (2) *illness* (e.g., "will I get sick?"); (3) *activities* (e.g., "when will I go to school?"); (4) *mitigation strategies* (e.g., "how does a mask help?"); and (5) *other consequence-related COVID-19 questions*.

Reliability

Interrater reliability was established with a randomly-selected sample of 19% of responses. Two research assistants independently coded the data. Overall agreement was high for each coding scheme (>93% agreement; Cohen's $\kappa > .85$). All discrepancies were resolved through discussion.

RESULTS

We first explore parental explanations, considering age-related changes in the method and content of explanations. Second, we examine children's COVID-19-related questions.

Research Question 1: How Have Parents Explained COVID-19 to Their Children?

We first asked how parents explained COVID-19 to their children. One hundred seventy (93.41%) parents provided responses.

Explanation Method

Out of 170 parental explanations, 14 % of parental explanations used an *illness analogy* (e.g., "it is like the flu, but worse"), 24.71% *referenced germs* (e.g., "people are wearing masks to stop the spread of germs"), 7.05% *used third-party knowledge* (video, article; g., "we watched the Sesame Street episode about Corona"), and 55.88% were labeled as *general explanations*, which included no method/strategy in their explanation (Table 1).

We next explored age-related differences in each of the *method* explanation categories with more than 10% of responses (to account for power; illness analogy, germs, general explanations). We ran separate binomial logistic regressions with age (in years) and essential worker status

Table 2
Coding Scheme) for Children's Questions Related to COVID-19

Question categories	*Main codes*	*Examples and sub codes*
Questions related to COVID-19 itself	Pandemic onset	*Causal* ("How did it start?")
		Fact-Based ("Where did it start?")
	Pandemic conclusion	*Length* ("When will the virus end?")
		Cure ("When will there be a vaccine?")
	Disease symptoms	"Why do people who have virus have different symptoms?"
		"How long do the germs stay in your body?"
Questions about the consequences of COVID-19	Death	*Others Dying* ("Can mommy or daddy die?")
		Self ("Will I die?")
	Illness	*Others* ("Will mom get sick?")
		Self ("Will I get sick?")
	Activities	*School* ("Why cannot I go to school?")
		Seeing people ("When can we go see friends?")
		Playground ("When can we go to playgrounds?")
		Restaurant ("Can we go to a fancy dinner in a restaurant?")
	Mitigation strategies	"Will we wear masks forever?"
	Other	"What happens to people who are homeless?"

as predictors on the likelihood of using the method type. For *illness analogy*, age was a significant predictor ($\beta = .350$, (SE) = .141. $p = .013$, $OR = 1.42$; over 92% of the analogical explanations came from parents of children aged 5–8). Essential worker status was not significant ($\beta = -.135$, (SE) = .464. $p = .7$). Explanations that *referenced germs* decreased with age ($\beta = -1,.033$, (SE) = .396. $p = .009$, $OR = .356$); 74% of explanations that referenced germs came from parents of children aged 3–5. Essential worker status was not significant, ($\beta = .146$, (SE) = .378. $p = .7$). For *general explanations* (used no specific strategy), there were no significant main effects. When explaining COVID-19 to their children, parents' analogical explanations increased with age, whereas explanations that reference germs decreased with age. We next explored the *content* of the explanations. Sixty-eight percent of explanations *mentioned illness*, 8.82% discussed *causing death*, 74.71% *mentioned mitigation strategies* (see Table 1). Recall that *mitigation strategies* were further divided into several codes: 35.43% of explanations discussed *social distancing*, 33.07% mentioned *handwashing*, 18.11% mentioned *wearing masks*, and 86.61% discussed the *loss of activities* (e.g., not going to school).

For each of the two main codes above 10% (*mentioned illness* and *mitigation strategies*), we ran separate binomial regression models with age (in years) and essential worker status as predictors. For *illness* and *mitigation strategies*, there were no significant main effects. Due to the small number of explanations mentioning that COVID-19 *caused death*, we were unable to run a separate model with this code. Visual inspection indicates that 80% of explanations mentioning that COVID-19 *caused death*, came from parents of children aged 6–8.

Question 1B. Science behind COVID-19

Parents reported, which of six items (not mutually exclusive) they used to explain the science behind COVID-19 to their child. One hundred and five parents (57.7%) provided responses. The results indicate that 52.38% of parents reported using analogies, 29.52% reported using illustrations, 30.48% reported using pictures, 19.05% reported using fictional stories, 35.24% reported using videos and 10.48% reported using models to explain the science behind COVID-19 to their child.

Research Question 2: What Questions Are Parents Reporting their Children Are Asking at Home Related to COVID-19?

Parents were invited to report all the questions that their children have asked related to COVID-19. One hundred thirty-one (72%) parents shared questions that their children have asked. The total number of questions reported was 314.

Children's questions were categorized as *questions about COVID-19* (34.39% of total questions) *itself* or *questions about consequences of COVID-19* (65.61% of total questions).

Questions about COVID-19 Itself

Questions about COVID-19 itself were sorted into one of three mutually-exclusive categories: questions about the *pandemic onset*, *pandemic conclusion*, or *disease symptoms*. Fourteen percent of questions mentioned the onset (e.g., "why did it happen?"), 53.70% mentioned the conclusion (e.g., "when will it end?"), and 32.41% mentioned disease symptoms (e.g., "what does the virus look like in your body"). For onset-related questions, 26.67% were fact-based ("when did it start?"; $n = 4$) and 73% were causal questions ("how did

it start?"; $n = 11$). For conclusion-related questions, 89.66% were about the length of COVID-19 ("when will it end?"; $n = 51$) and 10.34% were about finding a cure ("when will there be a vaccine?"; $n = 6$).

We ran a separate model with child age (in years) and essential worker status on the likelihood of asking a specific type of question. For questions about the *pandemic onset*, essential worker status was significant ($\beta = 1.312$, (SE) = .596. $p = .028$, $OR = 3.71$). No effect of age was found ($\beta = -.155$, (SE) = .198, $p = .435$). For questions about the *pandemic conclusion* and *disease symptoms*, there were no main effects.

Questions about the Consequences of COVID-19

Questions about consequences of COVID-19 were further sorted into five mutually-exclusive categories: *death*, *illness*, *activities*, *wearing masks*, and *other consequence-related COVID-19 questions*. Analyses indicate that 10.2% of questions mentioned *death* (e.g., "will mom die?"), 14.56% discussed *illness* (e.g., "will mom get sick?"), 58.74% mentioned *activities* (e.g., "will I go to school?"), 6.31% mentioned *mitigation strategies* (e.g., "why wear masks?"), and 10.19% were classified as *other*, *consequence-related questions*. For questions about death, 76.19% referenced questions about others ($n = 16$), whereas 23.8% reference questions about the child ($n = 5$). For questions about *illness*, 56.67% were about other people getting sick ($n = 17$) and 43.33% were about the child getting sick ($n = 5$). For questions related to *activities*, 35.54% were about seeing other people ($n = 43$) and 28.93% were about going back to school ($n = 35$), 5.83% were about going to a playground ($n = 7$), 4.13% were about going back to multiple places ($n = 5$), 2.48% were about going back to a restaurant, and 23.14% were about other places ($n = 28$).

For each of three categories above 10% (*death*, *illness*, and *activities*), we ran separate binomial regression models with age and essential worker status as predictors on the likelihood of asking a specific type of question. For questions about *death*, age was a significant predictor ($\beta = .826$, (SE) = .201, $p < .001$, $OR = 2.28$). No effect of essential worker status was found ($\beta = .811$, (SE) = .515. $p = .20$). Specifically, parents do not report their children are asking COVID-19 death-related questions until age 5 (over 85% of such questions come from 6 to 8-year-old). For questions about *illness*, there were no main effects. For questions about the loss of *activities*, age was a significant predictor ($\beta = -.270$, (SE) = .094. $p = .004$, $OR = .763$), and essential worker status was not significant. Specifically, 66% of such questions come from children aged 3–5. In sum, whereas older children ask more questions about death, younger children appear to ask more questions about the loss of activities due to the pandemic.

DISCUSSION

We explored developmental changes in parental explanations and children's questions about COVID-19. Our first research question examined the method and content of parental explanations about COVID-19. We predicted that parental explanations would focus on the opaque process of disease transmission and behavioral changes associated with disease prevention. Overall, parents used multiple strategies to explain COVID-19, and such strategies varied with age. Parental explanations referenced germs as well as used analogies: comparing it to other viruses with which children are already familiar. These findings suggest that adult testimony plays a role in helping children learn about the existence of scientific phenomena that cannot be directly observed (Clegg et al., 2019; Harris et al., 2006; Harris & Koenig, 2006). Parental explanations referencing germs decrease with child age, suggesting that scientific question-asking exchanges may be one mechanism for children's early knowledge acquisition (Butler et al., 2020). In contrast, parents' analogical explanations increase with child age. Analogies help to draw a connection between a child's current knowledge and a new concept (Valle & Callanan, 2006); our findings indicate that a large proportion of parental analogies compared COVID-19 to well-known viruses such as the flu.

We also explored the content of parental explanations about COVID-19. Consistent with our hypothesis, the majority of parental explanations highlighted mitigation strategies (behavioral changes associated with disease prevention) such as staying home or wearing masks. Although only a small proportion of parents reported explanations focusing on death, the majority of such explanations were from parents with older children. These findings are consistent with research indicating that children develop an understanding that there are many different causes of death by this age (Menendez, Hernandez, & Rosengren, 2020; Panagiotaki, Hopkins, Nobes, Ward, & Griffiths, 2018). In addition, in line with prior research (Rosengren et al., 2014) demonstrating that White, middle-class parents in the United States try to protect their children from death, it is also plausible that parents in our study avoided explanations about death to protect their children from such upsetting information.

Our second research question focused on the process by which children might signal the need for information: namely, their COVID-related questions. In line with parental explanations, we anticipated that older children might ask more questions associated with death or illness, whereas younger children might ask questions about changes in their activities. Children's questions focused on behavioral consequences associated with COVID-19, as compared to the virus itself, which suggests children's concern with observable changes to their daily life.

When children asked about the consequences of COVID-19, they mostly focused on changes in activities or death. Consistent with our initial prediction, older children were more likely to ask death-related questions. This extends prior work suggesting that although parents in some Western societies may spontaneously provide information to children about death, children acquire knowledge through asking questions (Chouinard, 2007; Menendez et al., 2020)—and they consistently return to this topic through so-called "passages of intellectual search" (Tizard & Hughes, 1984). Whereas older children asked more questions related to death, younger children asked about changes in their activities (e.g., "why can't I see my friends?"), which may reflect visible ways in which the pandemic has impacted their lives.

Our findings highlight children's questions and parental explanations about COVID-19. One limitation of these findings is that because parents self-reported their own explanations and children's questions about COVID-19, we were not able to observe their actual conversations with children at home. Future research should record parent–child talk about COVID-19 to more fully explore the mechanisms associated with the question-explanation exchanges about this novel unobservable entity. Because scientists had a limited understanding about COVID-19 in May 2020 (although not about its existence), future research might explore how parent explanations might differ from a more well-understood disease such as the common cold. An additional limitation was the sample demographics. Although we aimed to recruit a diverse sample through a variety of efforts, most parents in our study were White. Moreover, families who were seriously impacted by this pandemic may not have had the time, physical or emotional energy, or privilege to participate (CDC, 2020; UNESCO, 2021). Future work should include a more diverse sample of parents across a variety of factors, including race and ethnicity and access to healthcare.

Taken together, these data help to elucidate the process through which children develop theories of unobservable entities. Young children use questions to learn about the COVID-19 pandemic. In turn, parents are providing developmentally modulated explanations to help their children make sense of this uncertain time.

Acknowledgments—We would like to thank Maya Sienkiewicz and Yuqi Zhang for their help with coding the data. We would also like to thank all of the parents who completed this survey.

Conflict of interest

The authors declare that there is no conflict of interest.

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