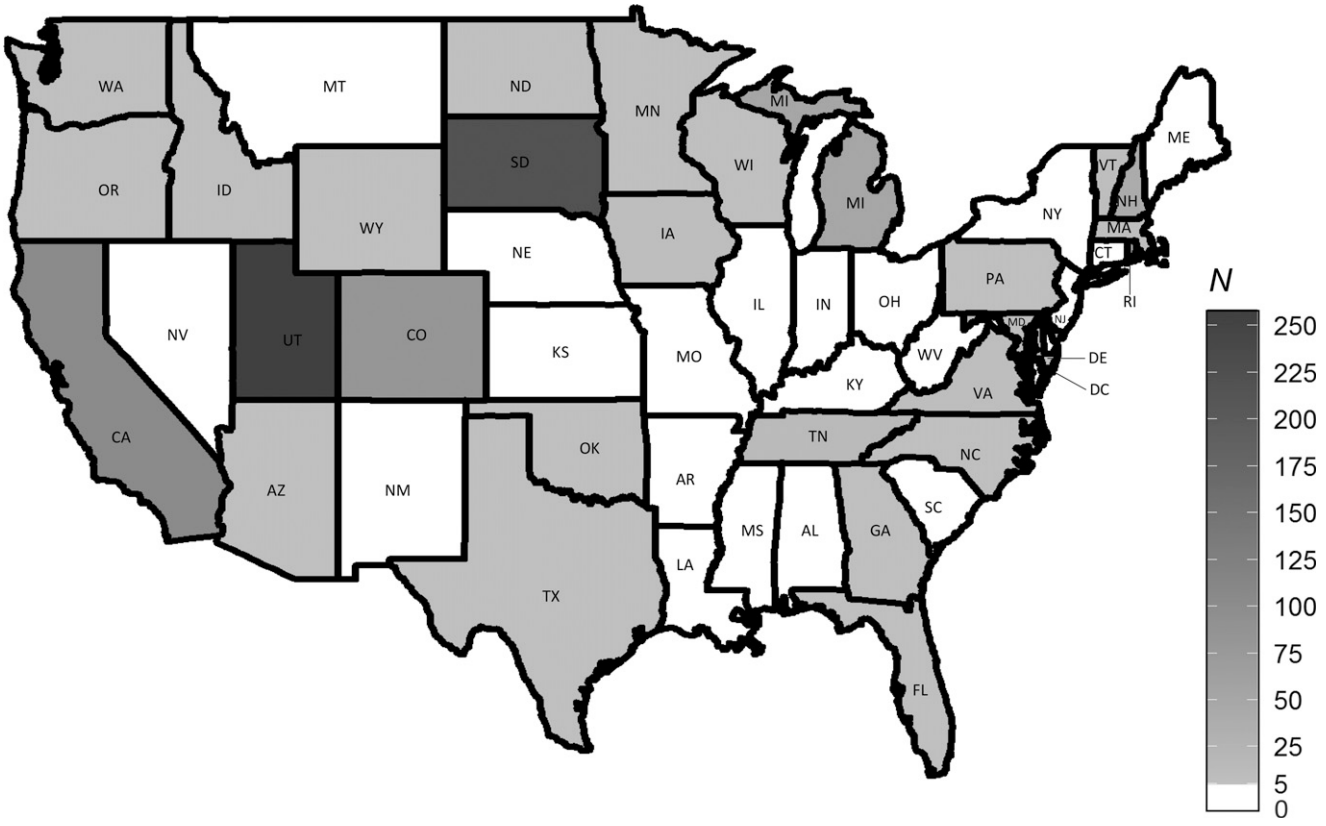
Supplemental Information

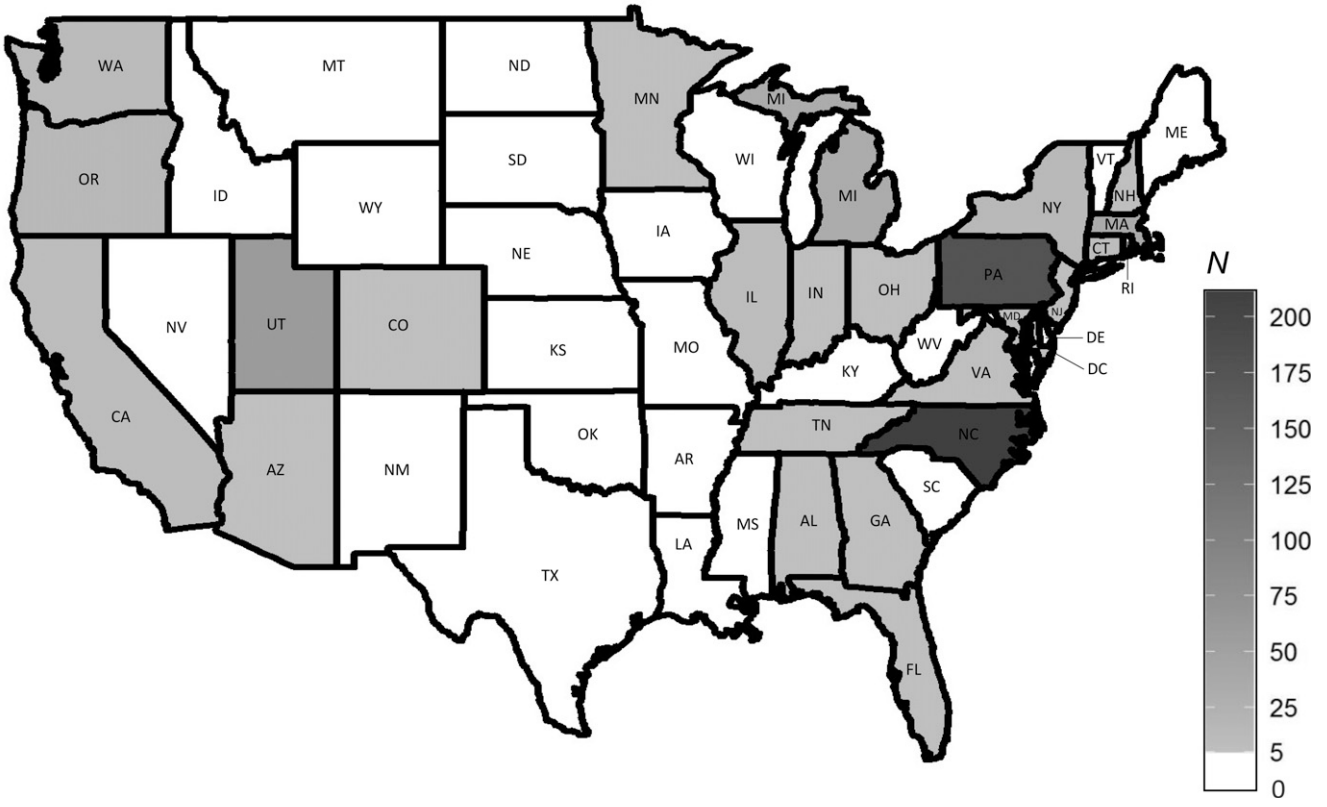
Description of the ECHO COVID-19 Questionnaire Development

The NIH ECHO COVID-19 Task Force led to the development of the ECHO COVID-19 questionnaires. The Task Force, co-chaired by ECHO investigators Tracy Bastain, PhD, and Carrie Breton, PhD, of the Keck School of Medicine at the University of Southern California, and comprised of 21 additional cohort investigators, as well as representatives from the ECHO NIH Program Office, Coordinating Center, Data Analysis Center, and Person-Reported Outcome Core, developed questionnaires for pregnant women and caregivers, children aged 0 to 12 years (via parent-report), and adolescents aged 13 years and older (via self-report). The purpose of these questionnaires is to assess the impact of being infected with and living during the time of the COVID-19 outbreak. Questionnaire content included original items developed by the Task Force, as well as modified items from existing surveys and source materials outlined below (in alphabetical order). ECHO questionnaires are publicly available from the NIH Disaster Relief Research program (DR2; https://www.nlm.nih.gov/dr2/COVID-19_BSSR_Research_Tools.pdf) and the NIH PhenX Toolkit COVID-19 Protocol Library (https://www.phenxtoolkit.org/covid19).

1. Acute Stress Disorder Scale, designed by Julie Herbstman, PhD, Columbia University Mailman School of Public Health; Amy Margolis, PhD, Columbia University Irving Medical Center; and Molly Algermissen, PhD, New York State Psychiatric Institute (NYSPI), Columbia University.
2. Adolescent Social Connection & Coping during COVID-19 Questionnaire (04.05.20), designed by Jennifer Pfeifer, PhD, University of Oregon Center for Translational Neuroscience.
3. Assessment of COVID-19 Experiences for Adolescents research tracker and facilitator, led by Jennifer Pfeifer, PhD, University of Oregon Center for Translational Neuroscience, and Cecile Ladouceur, PhD, University of Pittsburgh.
4. Centers for Disease Control (CDC) Self-Checker Survey: https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html.
5. Centers for Disease Control (CDC) COVID-19 Community Survey Question Bank.
6. The Collaborating Consortium of Cohorts Producing NIDA Opportunities (C3PNO) COVID-19 survey.
7. Johns Hopkins University COVID-19 and Mental Health Measurement Working Group, Department of Mental Health, Johns Hopkins Bloomberg School of Public Health.
8. McNally JW, Lavender KM, Levenstein MC. ICPSR Working Paper 2: Best Practices for Measuring Social, Behavioral, and Economic Impact of Epidemics. Ann Arbor, MI: ICPSR, University of Michigan; 2020.
9. New York University (NYU) Children's Health and Environment Study (CHES) Cohort survey, designed by the NYU Grossman School of Medicine cohort center team led by Leonardo Trasande, MD, MPP, NYU Langone Health.
10. Thomason Graham Perinatal Survey for the Covid-19 and Perinatal Experiences (COPE) Study, designed by Moriah Thomason, PhD, NYU Langone Health; Alice Graham, PhD, Oregon Health and Science University; Elinor Sullivan, PhD, Oregon Health and Science University; and Michelle VanTieghem, PhD, NYU Langone Health.
11. World Health Organization (WHO). Global surveillance for COVID-19 caused by human infection with COVID-19 virus. WHO reference number: WHO/2019-nCoV/SurveillanceGuidance/2020.6. 20 March 2020. https://www.who.int/publications-detail/global-surveillance-for-human-infection-with-novel-coronavirus-(2019-ncov).



SUPPLEMENTAL FIGURE 2
Child sample (2- to 12-year-old) participant frequencies across the continental United States. Children included in the 2- to 12-year-old child sample represented 27 states from the continental United States, primarily from the West and Midwest, and ranged in sample size from $n < 5$ to $n = 258$ per state.



SUPPLEMENTAL FIGURE 3

Adolescent sample (11- to 17-year-old) participant frequencies across the continental United States. Adolescent participants from the 11- to 17-year-old adolescent sample represented 25 states in the continental United States, primarily from the Northeast and Southeast, and ranged in sample size from $n < 5$ to $n = 211$ per state.

SUPPLEMENTAL TABLE 3 Cohort Descriptions

Cohort	Sample Description	Study Aims	2- to 12-Year-Old Child Sample	11- to 17-Year-Old Adolescent Sample
A	Colorado community sample of mother–child dyads recruited in infancy from obstetrics clinics at a university hospital and by word of mouth, as well as medical university employees.	To understand the contribution of metabolic and behavioral factors during pregnancy to the development of childhood obesity, insulin resistance, and inflammatory markers.	X	
B	White and American Indian women recruited in pregnancy from participating obstetrics and gynecology clinics and other entities (eg, the Supplemental Nutrition Program for Women, Infants, and Children) in South Dakota.	To investigate the relationship between prenatal alcohol exposure, stillbirth, and sudden infant death syndrome.	X	
C	Women identified as pregnant via hospital records from 4 California hospitals recruited before 10 wk gestation via telephone and their offspring.	To examine whether bisphenol A levels are associated with gestational diabetes and growth development.	X	
D	Diverse general pregnancy sample recruited during the first prenatal visit at 1 of 17 hospitals within a large hospital system in California and their offspring.	To investigate the role of in-utero exposure to endocrine-disrupting compounds in relation to child obesity and neurodevelopment disorders.	X	
E	Pregnant women recruited from 5 prenatal clinics in rural New Hampshire and their offspring.	To investigate the impact of in-utero and early life environmental contaminants (eg, arsenic) on maternal prenatal health, birth outcomes, growth, and neurodevelopment.	X	
F	A majority African American sample of mother–child dyads recruited in pregnancy in Memphis, Tennessee, from safety-net obstetrical clinics and local OB/GYN partners, television and radio advertisements, and directed mailings.	To understand early life predictors of child socioemotional and neurocognitive development.	X	
G	Pregnant women recruited during their first prenatal visit at 1 of 3 prenatal clinics in Lansing, Michigan.	To examine pre- and perinatal environmental contaminants, nutritional factors, and inflammation in mother–infant dyads in the context of their social and psychological environment on child neurodevelopmental and obesity outcomes.	X	

SUPPLEMENTAL TABLE 3 Continued

Cohort	Sample Description	Study Aims	2- to 12-Year-Old Child Sample	11- to 17-Year-Old Adolescent Sample
H	Children recruited between 3 mo and 12 y of age from the general population recruited in pediatrician offices and via online Web sites, radio advertisements, and flyers in Providence, Rhode Island.	To examine typical brain development, including how brain growth is altered by specific pre- and post-natal environmental or genetic factors; how patterns of brain growth are associated with, and predictive of, emerging cognitive and behavioral abilities; and how these brain–behavior relationships are influenced by modifiable factors experienced throughout childhood.	X	
I	Families (biological mother, partner, child) recruited in the second trimester at OB/GYN clinics in northern Virginia.	To investigate how prenatal and childhood prooxidant environmental factors affect children's neurodevelopment.	X	
J	Biological parents, adoptive parents, and their children recruited at the time of birth through adoption agencies in Oregon, Washington, Texas, Maryland, Pennsylvania, Virginia, New Jersey, California, Utah, Minnesota, Illinois, and Florida.	To examine how family, peer, and contextual processes affect children's adjustment, and to examine their interplay (mediation, moderation) with genetic influences.	X	X
K	Utah population-based cohort composed of children who were followed preconceptually or prenatally in previous cohort studies, up to 1 sibling and up to 2 biological parents; and women recruited preconceptually and their offspring, up to 1 sibling and biological father.	To evaluate innovative approaches to assess exposures at the earliest critical windows of human development, including the microbiome and dental examinations, and examine the role of genetics and the environment on children's growth, obesity, respiratory health, and asthma.	X	X
L	Preterm infants (<28 wk gestation) recruited from 1 of 15 US hospitals in North Carolina, Michigan, Illinois, Connecticut, and Massachusetts.	To investigate neurodevelopmental outcomes (eg, cerebral palsy, cognitive impairment, autism spectrum disorder, anxiety, depression, brain MRI abnormalities) in an extremely preterm population.		X
M	Dominican or African American mothers and their newborns recruited at OB/GYN clinics in New York, New York.	To investigate the associations between prenatal exposure to environmental toxic pollutants and adverse childhood outcomes, including reduced IQ, ADHD, and obesity.		X

SUPPLEMENTAL TABLE 3 Continued

Cohort	Sample Description	Study Aims	2- to 12-Year-Old Child Sample	11- to 17-Year-Old Adolescent Sample
N	Population-based primary caregiver–child dyads (and secondary caregiver when available), with oversampling for poverty and African American participants, in predominantly low-income, nonurban counties recruited at birth from 1 of 7 hospitals in Pennsylvania or North Carolina.	To investigate associations between psychosocial early life stress and neurodevelopment, including executive function, emotion regulation, language development, school achievement, and ADHD.		X

ADHD, attention-deficit/hyperactivity disorder; OB/GYN, obstetrics and gynecology.

SUPPLEMENTAL TABLE 4 ECHO Acute Stress Disorder Scale Items by Version

Parent-Report	Adolescent Self-Report/Adult Self-Report
Had difficulty sleeping	Had difficulty sleeping
Startled easily	Startled easily
Had angry outbursts	Had angry outbursts
Seemed to have a sense of time slowing down	Felt a sense of time slowing down
Seemed in a daze	Felt in a daze
Seemed to try to avoid thoughts and feelings about COVID-19	Tried to avoid thoughts and feelings about COVID-19
Tried to avoid talking, reading, and/or watching information about COVID-19	Tried to avoid reading or watching information about COVID-19
Had distressing dreams	Had distressing dreams about COVID-19
Been distressed when he/she sees something that reminds him/her of COVID-19	Been distressed when I see something that reminds me of COVID-19
Did things that he/she had outgrown or acted younger than current age (eg, thumb sucking, bedwetting, requesting to sleep with parents)	

Item stem for all versions was, "Since becoming aware of the COVID-19 outbreak, how often have you/has the child . . . " All items were scored on a 5-point Likert scale: (1) Not at all, (2) Rarely, (3) Sometimes, (4) Often, (5) Very Often.

SUPPLEMENTAL TABLE 5 Covariance Matrix for 2- to 12-Year-Old Child Sample

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1. Family hardships	1																											
2. Caregiver stress	0.42	1																										
3. Youth acute stress	0.32	0.52	1																									
4. Youth life satisfaction	−0.16	−0.21	−0.41	1																								
5. Youth social connectedness	−0.19	−0.19	−0.30	0.27	1																							
6. Family engagement	0.28	0.12	0.08	0.04	−0.03	1																						
7. Youth has anxiety or depression	0.08	0.05	0.14	−0.14	−0.08	−0.02	1																					
8. Youth has other mental health condition	0.01	−0.04	0.03	−0.05	−0.04	−0.07	−0.07	1																				
9. Youth stress social connectedness	0.14	0.09	0.09	−0.12	−0.79	0.08	0.03	0.05	1																			
10. Youth stress family engagement	−0.36	−0.27	−0.34	0.12	0.15	−0.84	−0.02	0.05	−0.12	1																		
11. Youth stress anxiety or depression	−0.03	0.05	0.07	0.03	−0.01	0.03	−0.62	0.04	−0.02	−0.05	1																	
12. Youth stress other mental health condition	0.09	0.14	0.16	−0.03	−0.01	0.08	0.06	−0.82	−0.03	−0.13	−0.04	1																
13. Youth age	−0.11	−0.08	0.04	−0.17	−0.03	−0.09	0.17	0.12	0.02	0.07	−0.10	−0.13	1															
14. Youth sex (female)	−0.01	0.00	0.02	−0.04	0.01	−0.06	0.02	−0.09	−0.02	0.07	−0.01	0.07	0.08	1														
15. Caregiver some college	0.09	0.05	0.06	−0.07	−0.02	−0.10	0.03	−0.01	−0.03	0.07	0.02	−0.01	−0.03	−0.05	1													
16. Caregiver bachelor's degree	−0.06	−0.03	−0.03	0.08	0.05	0.04	0.02	−0.12	−0.03	−0.05	−0.01	0.08	−0.04	0.03	−0.43	1												
17. Caregiver masters, professional, or doctorate degree	0.01	0.00	−0.04	0.07	−0.05	0.13	−0.03	0.00	0.09	−0.09	0.03	0.00	−0.03	−0.02	−0.34	−0.47	1											
18. COVID-19 infection	0.11	0.04	0.01	0.00	0.01	0.02	−0.01	−0.04	0.00	−0.03	0.03	0.02	−0.01	−0.03	0.06	−0.01	−0.07	1										
19. Cohort A	0.03	−0.01	0.00	0.00	-0.07	0.06	0.04	0.04	0.06	−0.06	−0.03	−0.03	−0.03	−0.02	−0.06	−0.05	0.13	−0.02	1									
20. Cohort B	−0.15	−0.12	−0.10	0.05	0.23	−0.13	−0.03	0.07	−0.19	0.13	−0.02	−0.06	0.01	0.04	0.02	0.05	−0.06	0.01	−0.13	1								
21. Cohort C	0.11	0.11	0.06	−0.02	−0.04	0.04	−0.05	−0.06	0.03	−0.06	0.03	0.08	−0.30	−0.04	0.03	0.05	−0.02	−0.04	−0.05	−0.16	1							
22. Cohort D	0.03	0.05	0.01	0.04	−0.06	−0.03	−0.04	−0.07	0.08	0.02	0.03	0.06	−0.23	−0.04	0.04	−0.03	0.04	0.03	−0.04	−0.12	−0.05	1						
23. Cohort E	0.06	0.05	0.10	−0.03	−0.10	0.01	−0.05	−0.08	0.05	−0.04	0.03	0.07	0.11	0.00	−0.06	−0.06	0.18	−0.03	−0.05	−0.14	−0.06	−0.05	1					
24. Cohort F	0.01	−0.08	0.00	−0.09	0.04	−0.07	0.07	0.03	−0.07	0.07	−0.15	−0.04	0.26	0.03	0.02	−0.09	−0.06	−0.02	−0.03	−0.09	−0.04	−0.03	−0.04	1				
25. Cohort G	0.00	−0.03	0.01	−0.01	0.03	0.00	0.04	0.12	0.01	0.01	0.02	−0.09	0.17	0.07	−0.01	−0.02	−0.05	−0.02	−0.03	−0.09	−0.04	−0.03	−0.04	−0.02	1			
26. Cohort H	−0.02	0.03	0.03	−0.11	−0.11	−0.06	−0.05	0.05	0.03	0.05	0.04	−0.01	0.11	0.00	0.03	−0.15	−0.10	−0.01	−0.06	−0.19	−0.08	−0.06	−0.07	−0.05	−0.05	1		
27. Cohort I	0.02	0.04	−0.05	0.08	0.01	0.12	0.05	−0.10	0.02	−0.08	0.01	0.06	−0.08	−0.03	0.02	0.16	−0.10	0.06	−0.13	−0.37	−0.16	−0.13	−0.14	−0.10	−0.10	−0.19	1	
28. Cohort J	0.03	−0.01	0.01	0.04	−0.02	0.10	0.00	0.01	0.05	−0.06	0.03	−0.01	−0.07	0.03	−0.06	0.01	0.08	0.01	−0.03	−0.10	−0.04	−0.03	−0.04	−0.03	−0.03	−0.05	−0.10	1

SUPPLEMENTAL TABLE 6 Covariance Matrix for 11- to 17-Year-Old Adolescent Sample

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Family hardships	1																					
2. Caregiver stress	0.47	1																				
3. Youth acute stress	0.15	0.12	1																			
4. Youth life satisfaction	0.00	−0.05	−0.35	1																		
5. Youth social connectedness	−0.09	−0.13	−0.23	0.23	1																	
6. Family engagement	0.39	0.27	0.06	0.11	−0.03	1																
7. Youth has anxiety or depression	0.06	0.15	0.26	−0.20	−0.15	0.02	1															
8. Youth has other mental health condition	0.06	−0.01	−0.08	0.05	0.00	0.02	−0.24	1														
9. Youth stress social connectedness	0.10	0.10	0.27	−0.20	−0.61	0.04	0.08	0.02	1													
10. Youth stress family engagement	−0.31	−0.22	−0.15	−0.04	0.03	−0.67	−0.08	0.01	−0.10	1												
11. Youth stress anxiety or depression	0.05	0.02	0.42	−0.12	−0.09	−0.05	−0.22	0.05	−0.03	−0.05	1											
12. Youth stress other mental health condition	−0.03	0.04	0.33	−0.12	−0.04	0.02	0.16	−0.69	0.09	−0.07	−0.04	1										
13. Youth age	−0.10	−0.06	0.05	−0.07	0.00	−0.09	0.07	0.07	0.03	0.04	0.00	−0.04	1									
14. Youth sex (female)	0.04	−0.01	0.27	−0.09	−0.09	0.04	0.06	−0.15	0.13	−0.07	0.13	0.18	0.04	1								
15. Caregiver some college	−0.05	−0.05	−0.02	−0.05	−0.05	−0.04	0.07	−0.01	0.03	0.04	−0.09	0.04	0.03	−0.08	1							
16. Caregiver bachelor's degree	0.05	−0.01	−0.02	0.04	0.04	0.11	−0.06	−0.11	0.02	−0.12	0.02	0.12	−0.07	0.04	−0.41	1						
17. Caregiver masters, professional, or doctorate degree	0.10	0.06	0.05	0.02	−0.06	0.07	0.00	0.04	0.04	−0.04	0.05	−0.04	0.04	0.03	−0.28	−0.22	1					
18. COVID-19 infection in the home	0.09	0.10	0.04	−0.04	−0.01	0.07	−0.03	0.06	0.02	−0.04	0.01	0.00	0.04	−0.02	0.02	0.01	0.00	1				
19. Cohort A	0.11	0.07	0.06	−0.02	−0.03	0.06	0.05	0.00	0.01	−0.02	−0.01	0.01	−0.44	−0.04	−0.05	−0.05	0.15	0.00	1			
20. Cohort B	0.05	0.09	0.02	0.00	−0.09	0.07	0.04	0.16	0.07	−0.09	−0.04	−0.13	0.49	0.04	−0.03	0.03	0.11	0.03	−0.19	1		
21. Cohort C	0.04	0.04	−0.04	0.07	0.00	0.16	−0.06	−0.13	0.00	−0.15	0.01	0.11	−0.38	0.08	−0.03	0.20	−0.03	0.05	−0.12	−0.16	1	
22. Cohort D	−0.04	−0.02	0.01	−0.05	−0.03	−0.06	0.04	−0.02	0.04	0.04	0.00	−0.01	0.04	0.00	−0.02	−0.04	−0.02	0.01	−0.07	−0.09	−0.05	1

SUPPLEMENTAL TABLE 7 Frequencies for the Initial 24 COVID-19–related Family Hardships Used in the Multivariate LASSO Regressions

	2- to 12-Year-Old Child Sample (n = 977)		11- to 17-Year-Old Adolescent Sample (n = 669)	
	n	%	n	%
Concerns about the child[a,b]	678	69.4	380	56.8
Social distancing or quarantine[a,b]	570	58.3	322	48.1
Concerns about the family[a,b]	505	51.7	395	45.6
Concerns about health[a,b]	408	41.8	266	39.8
Concerns about the community	353	36.1	206	30.8
Concerns about work	323	33.1	196	29.3
Financial concerns[a,b]	304	31.1	198	29.6
Rearranged work schedule to stay at home for child care	253	25.9	35	5.2
Difficulty arranging child care[a]	234	19.4	15	2.2
Primary caregiver had high-risk job	180	18.4	131	19.6
Access to personal or household supplies[a]	150	15.4	111	16.6
Health care access[a]	138	14.1	68	10.2
Spouse had high-risk job	136	13.9	69	10.3
Primary caregiver worked less hours	127	13.0	81	12.1
Spouse worked more hours	101	10.3	38	5.7
Food insecurity[b]	87	8.9	66	9.9
Primary caregiver worked more hours	85	8.7	68	10.2
Spouse worked less hours	82	8.4	54	8.1
Primary caregiver had temporary job loss	78	8.0	55	8.2
Paid more for child care	86	7.1	<5	<1
Primary caregiver lost job	42	4.3	18	2.7
Access to baby supplies	36	3.7	7	1.1
Spouse had temporary job loss	33	3.4	39	5.8
Spouse lost job	25	2.6	16	2.4

Hardships are listed in descending order of frequency on the basis of the 2- to 12-year-old child sample.

[a]Item included in the LASSO results for the child sample.

[b]Item included in the LASSO results for the adolescent sample.

SUPPLEMENTAL TABLE 8 Results from Multivariate LASSO Regression, Caregiver-reported, COVID-19–related Family Hardships on Caregiver and Youth COVID-19 Acute Stress, by 2- to 12-Year-Old Child and 11- to 17-Year-Old Adolescent Samples

	2- to 12-Year-Old Child Sample (n = 977)		11- to 17-Year-Old Adolescent Sample (n = 669)	
	Caregiver Stress	Youth Stress	Caregiver Stress	Youth Stress
Concerns about the child	1.35	1.24	1.31	0.79
Social distancing or quarantine	0.64	0.30	0.44	0.15
Concerns about the family	0.70	0.58	0.72	0.27
Concerns about health	0.24	0.18	1.17	0.26
Concerns about the community	—	—	—	—
Concerns about work	—	—	—	—
Financial concerns	0.84	0.56	—	—
Rearranged work schedule to stay at home for child care	—	—	—	—
Difficulty arranging child care	0.11	0.14	—	—
Primary caregiver had high-risk job	—	—	—	—
Access to personal or household supplies	0.14	0.07	—	—
Health care access	1.33	0.92	—	—
Spouse had high-risk job	—	—	—	—
Primary caregiver worked less hours	—	—	—	—
Spouse worked more hours	—	—	—	—
Food insecurity	—	—	0.32	0.02
Primary caregiver worked more hours	—	—	—	—
Spouse worked less hours	—	—	—	—
Primary caregiver had temporary job loss	—	—	—	—
Paid more for child care	—	—	—	—
Primary caregiver lost job	—	—	—	—
Access to baby supplies	—	—	—	—
Spouse had temporary job loss	—	—	—	—
Spouse lost job	—	—	—	—
Intercept	16.34	14.55	14.82	16.56

Values represent regression coefficients. Hardships are listed in descending order of frequency on the basis of the 2-to 12-year-old child sample (Supplemental Table 7). —, item removed as a result of the LASSO regression analysis.