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Comparison of Upper Respiratory Viral Load Distributions in Asymptomatic and Symptomatic Children Diagnosed with SARS-CoV-2 Infection in Pediatric Hospital Testing Programs

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ABSTRACT The distribution of upper respiratory viral loads (VL) in asymptomatic children infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is unknown. We assessed PCR cycle threshold (Ct) values and estimated VL in infected asymptomatic children diagnosed in nine pediatric hospital testing programs. Records for asymptomatic and symptomatic patients with positive clinical SARS-CoV-2 tests were reviewed. Ct values were (i) adjusted by centering each value around the institutional median Ct value from symptomatic children tested with that assay and (ii) converted to estimated VL (numbers of copies per milliliter) using internal or manufacturer data. Adjusted Ct values and estimated VL for asymptomatic versus symptomatic children (118 asymptomatic versus 197 symptomatic children aged 0 to 4 years, 79 asymptomatic versus 97 symptomatic children aged 5 to 9 years, 69 asymptomatic versus 75 symptomatic children aged 10 to 13 years, 73 asymptomatic versus 109 symptomatic children aged 14 to 17 years) were compared. The median adjusted Ct value for asymptomatic children was 10.3 cycles higher than for symptomatic children ($P < 0.0001$), and VL were 3 to 4 logs lower

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than for symptomatic children ($P < 0.0001$); differences were consistent ($P < 0.0001$) across all four age brackets. These differences were consistent across all institutions and by sex, ethnicity, and race. Asymptomatic children with diabetes (odds ratio [OR], 6.5; $P = 0.01$), a recent contact (OR, 2.3; $P = 0.02$), and testing for surveillance (OR, 2.7; $P = 0.005$) had higher estimated risks of having a Ct value in the lowest quartile than children without, while an immunocompromised status had no effect. Children with asymptomatic SARS-CoV-2 infection had lower levels of virus in their nasopharynx/oropharynx than symptomatic children, but the timing of infection relative to diagnosis likely impacted levels in asymptomatic children. Caution is recommended when choosing diagnostic tests for screening of asymptomatic children.

KEYWORDS COVID-19, SARS-CoV-2, diagnostics, pediatric infectious disease

Compared to adults, children have been less impacted by the coronavirus (CoV) disease 2019 (COVID-19) pandemic in terms of both disease incidence and severity (1); this has held true even in populations known to be at high risk of complications from other respiratory viruses, such as infants (2) and immunocompromised children (3). Early reports suggested that children were not major contributors to severe acute respiratory syndrome (SARS)-CoV-2 spread (4), but shelter-in-place advisories and school closures early in the pandemic responses may have limited opportunities for spread among children in the community. More recent data suggest that children can transmit SARS-CoV-2 to adults and other children, although transmission rates and the impact of age are unclear (5, 6). Despite our evolving understanding of COVID-19 epidemiology and transmission in children, many questions remain.

Upper respiratory viral loads are associated with transmission risk for other respiratory viruses (7, 8), but the association between SARS-CoV-2 upper respiratory viral load and transmission is unknown. Among those with nonsevere symptomatic COVID-19 illness, children have nasopharyngeal (NP) viral loads similar to those of adults (9), and young children may have greater NP viral loads than older children and adults (10). Culture-competent SARS-CoV-2 can be isolated from children of all ages with symptomatic COVID-19 (11). While these data highlight the potential for children of any age to transmit SARS-CoV-2, the differences in upper respiratory viral loads among children with and without symptoms of COVID-19 are unknown. In contrast, multiple studies have demonstrated high viral loads in asymptomatic adults, and the ability of asymptomatic adults to transmit SARS-CoV-2 has been well described (12, 13).

Identifying the role of children without COVID-19 symptoms in the transmission of SARS-CoV-2 is a critical unanswered question. Hospitals have established large-scale screening programs requiring testing of asymptomatic children prior to surgery, aerosol-generating procedures, and/or hospital admission. In the community, the role of asymptomatic children in the transmission of SARS-CoV-2 impacts decisions about the safety of reopening daycare centers and returning to classroom instruction in schools, as well as informing decisions regarding strategies for postexposure SARS-CoV-2 testing in asymptomatic children as a method for interrupting ongoing transmission.

To further clarify the viral burden in children infected with SARS-CoV-2, we performed a collaborative study of asymptomatic and symptomatic children tested by nine children's hospitals in the United States and Canada. Our objectives were to delineate the distribution of SARS-CoV-2 viral loads in upper respiratory samples from asymptomatic and symptomatic children diagnosed through hospital testing programs and to determine whether viral load distributions were consistent across age categories, SARS-CoV-2 assays, and institutions, all of which were experiencing different stages of COVID-19 community activity.

MATERIALS AND METHODS

Study population. Charts for patients (ages, 0 to 17 years) testing positive in SARS-CoV-2 assays in use for clinical testing at each institution were retrospectively reviewed (researchers were blind to cycle threshold [Ct] values, which were not reported clinically).

Symptomatic patients had two or more symptoms consistent with COVID-19 (cough, fever/chills, shortness of breath, sore throat, abdominal pain, diarrhea, fatigue, myalgias, new loss of taste or smell, headache, congestion/rhinorrhea, nausea/vomiting, rash, or conjunctivitis) at the time of testing and were tested due to clinical suspicion of COVID-19. Asymptomatic patients had no symptoms of COVID-19 (as defined above) or any clinical suspicion of COVID-19 (other than potential contact status) at the time of testing. The primary reason for testing was coded as either surveillance (contact tracing or broad community surveillance), a preoperative/aerosol-generating procedure (preop/AGP), or hospital admission screening (preadmission). Only the first positive test for each patient was included. Within each institution, each asymptomatic patient was matched with up to two symptomatic patients by age bracket (0 to 4 years, 5 to 9 years, 10 to 13 years, 14 to 17 years) and date of testing (as close as possible to the date of the first positive test for the asymptomatic patient but within 30 days).

At each institution, all asymptomatic and symptomatic patients compared were required to have been tested with the same sample type (either NP or oropharyngeal [OP]).

Clinical data collected for each patient at the time of testing included the following: age, sex, race, ethnicity, immunocompromised status, diabetes. For symptomatic patients, the presence/absence of symptoms from the list above were scored. For asymptomatic patients, data were also collected on known contacts and their timing prior to the test date (≤2 weeks, >2 weeks, or unknown) and any development of new symptoms of COVID-19 within 5 days of the positive test.

Ct values and viral load estimates. Molecular assay used and Ct values were recorded; if the assay had more than one target, the Ct values for the sample were averaged, and if only one target was positive, that single Ct was used. For each assay used at an institution, the median and interquartile range (IQR) of Ct values for all positive symptomatic pediatric patients (0 to 17 years) (or a representative subset) tested over the study period (i.e., the institutional symptomatic median) were calculated. For each assay used, each institution also provided a conversion between Ct value (which is inversely related to the amount of nucleic acid target in a sample) and estimated viral load (number of copies per milliliter of the original patient sample) based on data from internal validation studies, the manufacturer, or package inserts.

Statistical analysis. To address variation in Ct data due to the use of multiple assays by the nine institutions, we calculated adjusted Ct values using a centering technique. With this technique, the adjusted Ct values were the difference between individual Ct values and the institutional symptomatic median (defined above) for each respective assay. These observations are reported as adjusted Ct values.

Continuous variables were summarized using medians and IQRs; categorical variables were summarized using counts and percentages. Due to the nonnormality of data, the nonparametric Wilcoxon and Fisher exact tests were used to assess for significance of differences in continuous and 2 by 2 tables, as applicable. Logistic regression analysis was used to compare dichotomous outcomes and to generate odds ratios (ORs). Tests were 2-sided, and a P value of <0.05 was considered statistically significant. SAS (version 9.4; SAS Institute, Cary, NC) software was used.

Each institution independently obtained institutional review board approval for chart review with a waiver of informed consent; only fully deidentified data were analyzed.

RESULTS

Study periods for the nine institutions covered March to July 2020 (see Table S1 in the supplemental material). Age distributions and other demographic and comorbidity data for the combined asymptomatic ($n = 339$) and symptomatic ($n = 478$) populations are listed in Table 1. Patients contributed by each institution are summarized in Table S2. The distribution of symptoms in the symptomatic children is presented in Table S3.

Because Ct values are assay dependent and the goal was to analyze aggregate Ct data from multiple assays and institutions, Ct values for each assay were adjusted by centering each value around the institutional symptomatic median (see Materials and Methods and Table S1). Each institution also provided a viral load estimate (number of copies per milliliter of sample) for each Ct value (see Materials and Methods and Table S1).

Adjusted Ct values and estimated viral loads for asymptomatic versus symptomatic children in all age brackets were compared (Fig. 1). The median adjusted Ct value for asymptomatic children was 8.6 (IQR, 2.5 to 12.2) compared to −1.7 (IQR, −6.0 to 4.8) for symptomatic children ($P < 0.0001$), a Ct difference of 10.3 (Fig. 1A). We observed similar results when we compared median estimated viral loads in asymptomatic children (2.0×10^3 copies/ml [IQR, 162 to 1.7×10^5] and symptomatic children (1.3×10^7 copies/ml [IQR, 5.6×10^4 to 3.8×10^8]) ($P < 0.0001$) (Fig. 1B). Differences of similar magnitudes were observed in each of the four age brackets ($P < 0.0001$ for each age bracket, for both the adjusted Ct and the viral load) (Fig. 2A and B; Table S4), though, interestingly, the adjusted Ct difference narrowed with increasing age (11.95 Ct for ages 0 to 4 years, 10.32 Ct for ages 5 to 9 years, 9.78 Ct for ages 10 to 13 years, 8.49 Ct for ages 14 to 17 years), correlating with progressively decreasing median viral burdens in

TABLE 1 Study participants and demographics

Variable	No. (%) of children who were:		*P*
	Asymptomatic (*n* = 339)	Symptomatic (*n* = 478)	
Sex			
Male	178 (52.5)	248 (51.9)	0.887
Female	161 (47.5)	230 (48.1)	
Age bracket (yr)			
0–4	118 (34.8)	197 (41.2)	0.136
5–9	79 (23.3)	97 (20.3)	
10–13	69 (20.4)	75 (15.7)	
14–17	73 (21.5)	109 (22.8)	
Ethnicity			
Hispanic/Latino	169 (49.9)	285 (59.6)	0.002
Non-Hispanic/Latino	132 (38.9)	131 (27.4)	
Not specified	38 (11.2)	62 (13.0)	
Immunocompromised?			
Yes	35 (10.3)	16 (3.3)	<0.001
No	304 (89.7)	462 (96.7)	
Diabetes?			
Yes	9 (2.7)	10 (2.1)	0.642
No	330 (97.3)	468 (97.9)	
Race			0.002
Asian	16 (5.0)	11 (2.4)	
Black or African American	58 (18.1)	70 (15.2)	
White or Caucasian	135 (42.1)	161 (34.8)	
Other[a]	112 (34.9)	220 (47.6)	

[a]"Other" reflects the response of patients that did not wish to select one of the other race categories, based on chart review. Includes American Indian/Alaska Native (*n* = 1), Native Hawaiian/Other Pacific Islander (*n* = 1).

the symptomatic group within each age bracket (Fig. 2B; Table S4). These differences were consistent across all institutions (Fig. S1 and S2) and were not affected by sex or ethnicity (Table S4).

To understand whether there were any patient factors that could help predict the asymptomatic children with the lowest Ct values/highest viral loads, odds ratios were calculated to assess the estimated risk of having a Ct value in the lowest quartile (or a viral load in the highest quartile) within the asymptomatic Ct value distribution.

Asymptomatic children with diabetes (OR, 6.5; $P = 0.01$), recent contact with a COVID-19 case (OR, 2.3; $P = 0.02$), and testing for surveillance (OR, 2.7; $P = 0.005$) had a higher estimated risk of having a Ct value in the lowest quartile than children without, while an immunocompromised status had no effect (Table 2). Sex, race, and ethnicity also had no effect (Table 2). Similar results were obtained for the same analyses using estimated viral loads (Table 2). Comparisons of median adjusted Ct values and viral loads for asymptomatic patients with and without these risk factors are in Table S5.

Figure 3 compares adjusted Ct values (Fig. 3A) and estimated viral loads (Fig. 3B) in asymptomatic children by test indication (surveillance, preop/AGP, and preadmission) versus symptomatic children; Table S5 shows median adjusted Ct values and viral loads in those three groups. Asymptomatic children tested for surveillance had significantly lower median adjusted Ct values/higher estimated viral loads than those tested for preop/AGP or preadmission and significantly higher adjusted Ct values/lower estimated viral loads than symptomatic patients (Fig. 3). Figure S3 and S4 show the patients with an immunocompromised status and diabetes, respectively, highlighted within the adjusted Ct distributions for the asymptomatic and symptomatic populations; Fig. S5, S6, and S7 show the patients with known contacts, recent contacts, and those tested for surveillance, respectively, highlighted within the asymptomatic group.

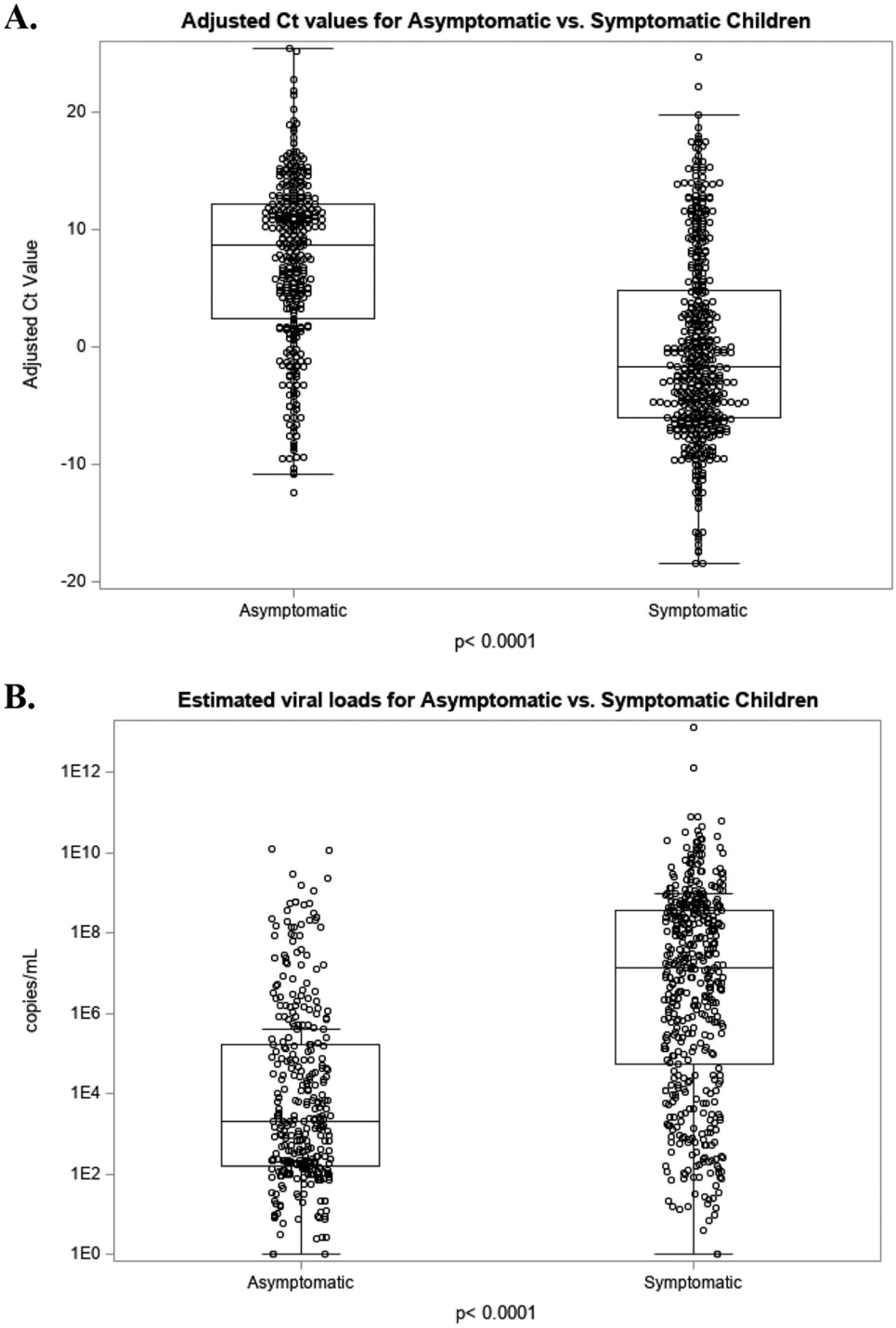

FIG 1 Comparison of adjusted Ct values (A) and estimated viral loads (B) for asymptomatic ($n = 339$) versus symptomatic ($n = 478$) children. The bottom and top edges of the boxes for each cohort indicate the interquartile range (IQR), the horizontal line bisecting the box indicates the median value, and the whiskers represent values 1.5 times the IQR. *P* values for comparison of the respective medians are shown.

Presymptomatic children (those who developed symptoms consistent with COVID-19 within 5 days following the test) trended toward higher median viral loads (7.7×10^4 [1.1×10^2 to 2.4×10^6]; $n = 14$) than non-presymptomatic children (1.4×10^3 [1.3×10^2 to 7.3×10^4], $n = 172$), though this difference was not significant ($P = 0.30$) (Table S5).

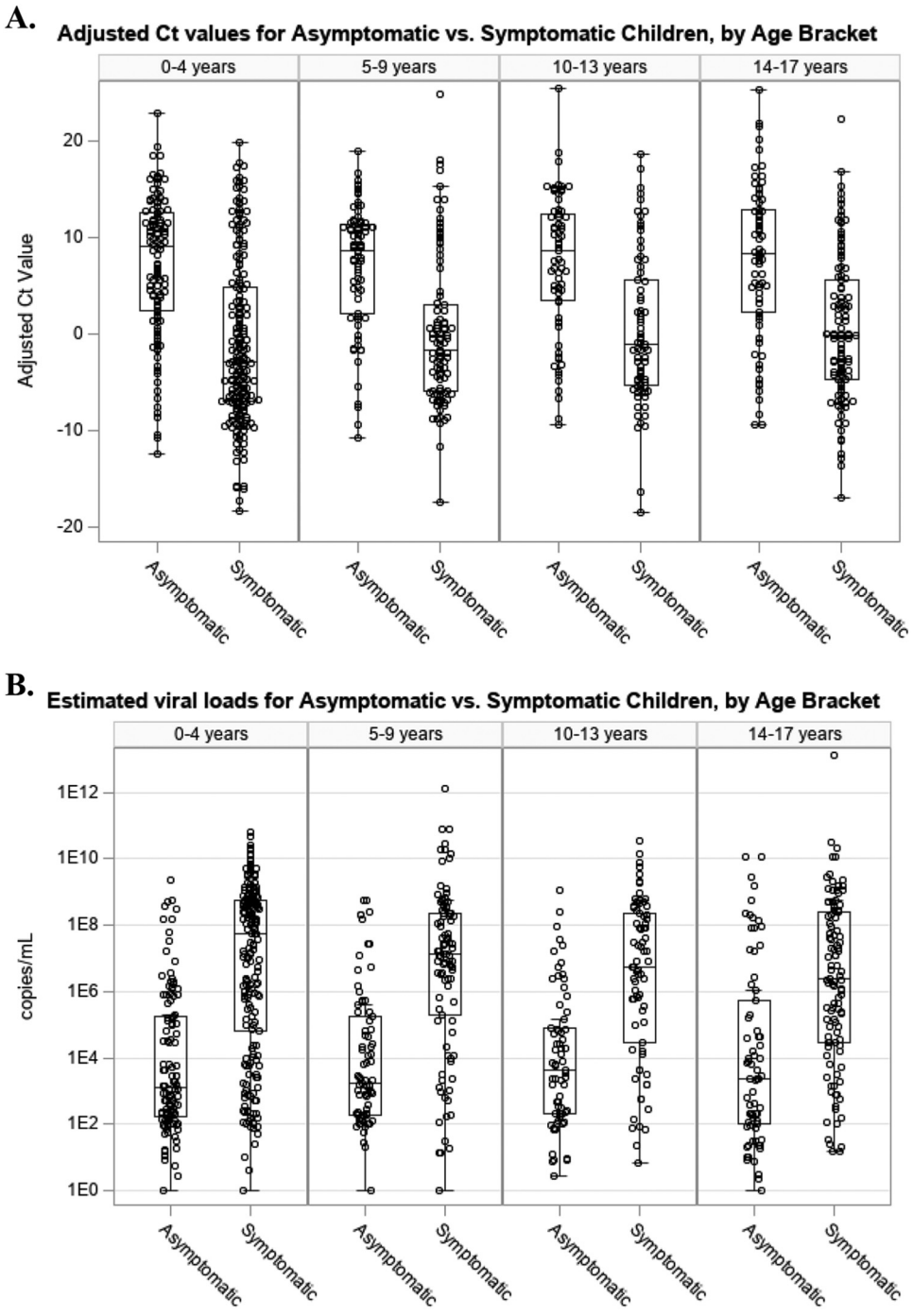

FIG 2 Comparison of adjusted Ct values (A) and estimated viral loads (B) for asymptomatic versus symptomatic children, separated by age brackets (118 asymptomatic versus 197 symptomatic children aged 0 to 4 years, 79 asymptomatic versus 97 symptomatic children aged 5 to 9 years, 69 asymptomatic versus 75 symptomatic children aged 10 to 13 years, 73 asymptomatic versus 109 symptomatic children aged 14 to 17 years). The bottom and top edges of the boxes for each cohort indicate the interquartile range (IQR), the horizontal line bisecting the box indicates the median value, and the whiskers represent values 1.5 times the IQR.

DISCUSSION

Our study explores the distribution of upper respiratory viral loads in asymptomatic children identified as infected with SARS-CoV-2 by hospital testing programs. By combining results from nine institutions testing pediatric patients, we assembled a robust data set across all age brackets for extensive analysis. We have demonstrated

TABLE 2 Estimated risks for being in the lowest quartile of adjusted Ct values or highest quartile of estimated viral loads in the asymptomatic population[a]

Explanatory factor (no. of patients)	OR (95% confidence interval) for the adjusted Ct value	*P*	OR (95% confidence interval) for the estimated viral load	*P*
Sex (339); male (178) vs female (161)	1.218 (0.743, 1.995)	0.4342	1.075 (0.659, 1.754)	0.7726
Race (339)		0.5816		0.4142
Asian (16) vs white or Caucasian (135)	1.855 (0.626, 5.4920)	0.2643	2.503 (0.864, 7.258)	0.0911
Black or African American (58) vs white or Caucasian (135)	0.893 (0.430, 1.855)	0.7615	1.123 (0.553, 2.282)	0.7488
Other[b] (112) vs white or Caucasian (135)	1.080 (0.607, 1.923)	0.7938	1.125 (0.630, 2.008)	0.6913
Ethnicity (339); Hispanic/Latino (169) vs non-Hispanic/Latino (132)	1.272 (0.749, 2.159)	0.3740	1.218 (0.720, 2.062)	0.4616
Immunocompromised (339); yes (35) vs no (304)	0.737 (0.310, 1.755)	0.4908	0.712 (0.299, 1.695)	0.4428
Diabetes (339); yes (9) vs no (330)	6.459 (1.579, 26.427)	0.0095	6.248 (1.528, 25.556)	0.0108
Known contact with COVID-19 case (235); yes (64) vs no (171)	1.968 (1.035, 3.743)	0.0390	2.190 (1.154, 4.157)	0.0164
Timing of known COVID-19 contact (57); ≤2 wk (48) vs >2 wk (9)	2.015 (0.993, 4.089)	0.0525	4.387 (0.505, 38.093)	0.1800
Recent contact (≤2 wk) (48) vs no known contact (171)	2.293 (1.135, 4.632)	0.0207	2.293 (1.135, 4.632)	0.0207
Reason for testing (339)		0.0104		0.0046
Surveillance (39) vs preop/AGP (245)	2.702 (1.349, 5.411)	0.0050	2.702 (1.349, 5.411)	0.0050
Surveillance (39) vs preadmission (55)	3.949 (1.521, 10.257)	0.0024	4.381 (1.691, 11.353)	0.0024
Preadmission (55) vs preop/AGP (245)	1.585 (0.732, 3.433)	0.2200	1.621 (0.749, 3.509)	0.2200
Surveillance (39) vs preop/AGP or preadmission (300)	2.687 (1.350, 5.351)	0.0049	2.925 (1.474, 5.804)	0.0021
Symptoms in 5 days after test; yes (14) vs no (172)	2.396 (0.786, 7.309)	0.1245	2.558 (0.837, 7.816)	0.0994

[a]The lowest quartile of adjusted Ct values was <2.47 ($n = 84$), and the highest quartile of estimated viral loads was $\geq 1.7 \times 10^5$ copies/ml ($n = 86$).
[b]"Other" reflects the response of patients that did not wish to select one of the other race categories, based on chart review.

that Ct values were significantly higher, and estimated viral loads significantly lower, in asymptomatic children of all ages than in symptomatic children matched by age bracket and test collection date range. These differences in viral burden were consistent across all nine collaborating institutions, each of which experienced a different stage of the pandemic over the study period and used a different panel of SARS-CoV-2 assays for patient testing, increasing the generalizability of our findings.

While asymptomatic and symptomatic children in this study clearly had different viral load distributions, there was overlap between these distributions in all age brackets, raising the key question of whether there were certain risk factors that could help to identify outliers in the asymptomatic population with the lowest quartile of Ct values/highest quartile of viral loads. Our analysis demonstrated that asymptomatic children with diabetes and/or recent contact with a COVID-19 case, as well as those tested for surveillance purposes (rather than for preprocedure or preadmission purposes), had a significantly higher estimated risk of being in the quartile with the highest viral burden. Despite the small numbers of diabetic patients in our study, the finding that diabetic children were more at risk of having high viral loads requires further dedicated investigation, as it is consistent with studies of adults that have demonstrated more severe disease and poorer prognoses in patients with diabetes (14, 15). The asymptomatic population with known/recent COVID-19 contact overlapped the population tested for surveillance purposes, though not perfectly (as some preprocedure or preadmission patients had contacts). Our data suggest that timing of infection impacted the viral load distribution among asymptomatic children in our study, with patients more likely to have recent infections (i.e., recent contacts) showing higher viral loads than those potentially more likely to have remote infections (those tested per a preprocedure/preadmission protocol).

Our finding of lower viral loads in the asymptomatic children in our study raises the question of what this might mean regarding their potential for disease transmission. There is evidence in the literature that asymptomatic individuals can spread infection, but these data are almost exclusively from adults. The prevalence of asymptomatic infection among different cohorts of infected adults has been estimated to range from 18 to 75% (16–24); cases of transmission from asymptomatic adults have been reported (25–28), and viable virus may be recovered in culture from samples collected from asymptomatic individuals (18, 29).

Correlation of the viral load with an ability to recover virus in culture is challenging,

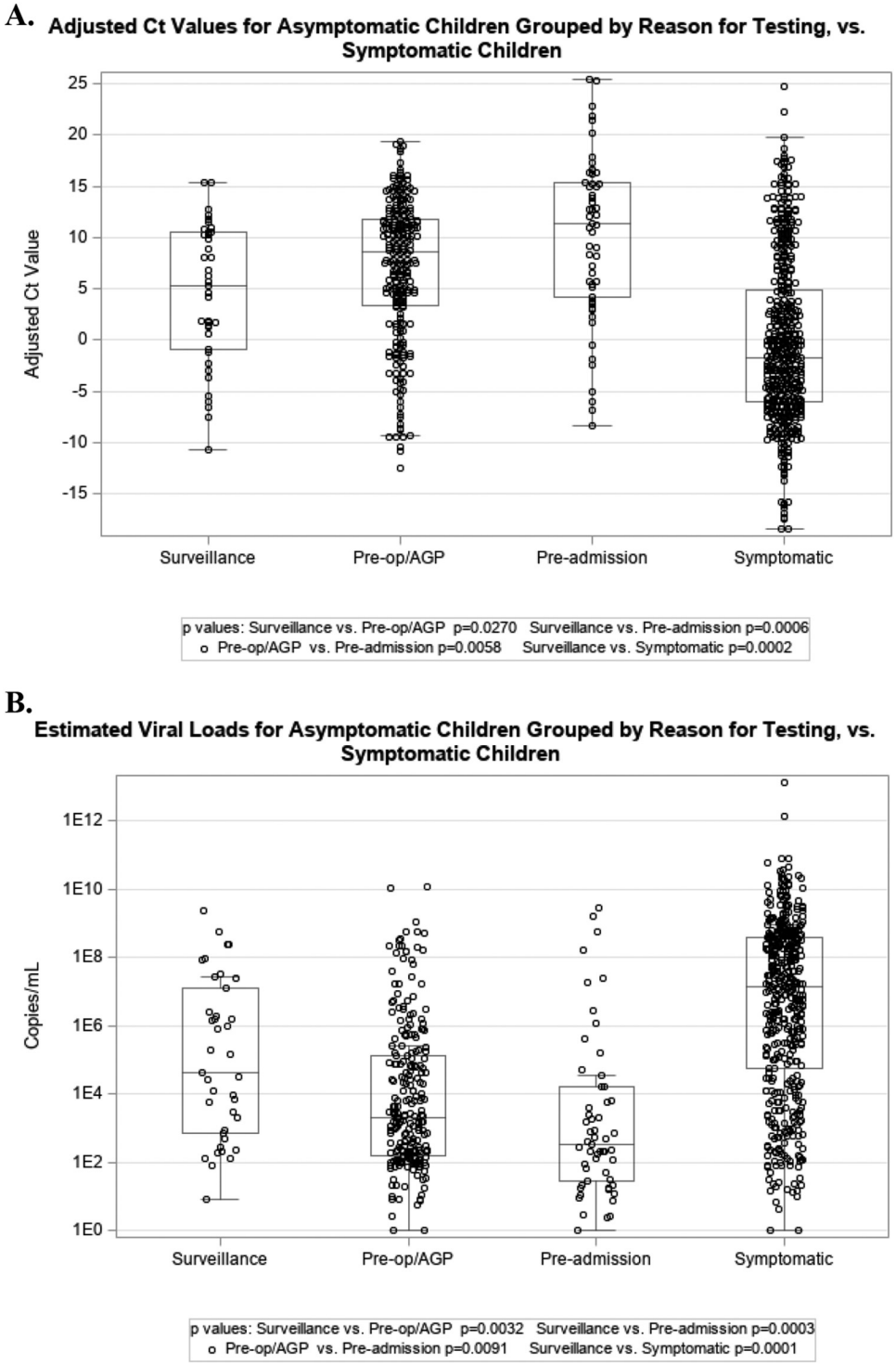

FIG 3 Comparison of adjusted Ct values (A) and estimated viral loads (B) for asymptomatic children tested for three different indications (surveillance, preop/aerosol-generating procedure, and preadmission) versus symptomatic children. The bottom and top edges of the boxes for each cohort indicate the interquartile range (IQR), the horizontal line bisecting the box indicates the median value, and the whiskers represent values 1.5 times the IQR. The *P* values for the comparison of the medians of the surveillance and preprocedure groups are shown.

though several investigators have reported difficulty in isolating virus when viral loads measured in patient samples are below approximately 1×10^5 copies/ml (9, 24, 30, 31). However, virus has been recovered from samples with RNA levels as low as 1.2×10^4 copies/ml (11). It is worth noting that although isolation of virus in culture has been

used as a surrogate for infectivity, an inability to recover replicating virus in culture does not necessarily preclude transmissibility (32).

Importantly, prior work examining whether the amounts of viral RNA in respiratory secretions differ between symptomatic and asymptomatic individuals has generally involved well-defined cohorts of adults, notably where exposure of the individuals within a given cohort likely occurred recently and, in many studies, at about the same time. In general, using either Ct values or conversions to viral loads, these studies have found roughly equivalent RNA levels between asymptomatic and symptomatic individuals (16–18, 21, 22, 33, 34). Given that asymptomatic patients with a recent known COVID-19 contact were more likely to have higher viral loads in our study, one hypothesis is that the lower median viral loads in the preprocedure/preadmission testing groups reflect that more of those children had remote infection. This suggestion is supported by a recent study of children who were all close contacts of people with SARS-CoV-2 infection; that study found similar viral loads on NP swabs from children with and without symptoms (though all reported viral loads were relatively low) (35). Unfortunately, there are minimal published data describing results of testing asymptomatic populations with a wider range of potential exposure times. One study which investigated asymptomatic adult health care workers who were identified as infected through a screening program found higher Ct values (and therefore lower viral loads) in those individuals than in adults with symptomatic infection (36).

Additional data in children are limited to very small studies with conflicting results about the comparability of SARS-CoV-2 RNA levels between symptomatic and asymptomatic children (37, 38). More generally, symptomatic children appear to have RNA levels comparable to or higher than those of adults (9–11), and unlike reports in adults (39), RNA levels in children do not appear to correlate with severity of illness (40).

Our study has some important limitations. As noted above, given that our asymptomatic population may be biased toward lower viral loads due to a higher frequency of remote infections picked up on screening testing, it may not fully represent the distribution of viral loads in recently infected asymptomatic children. We note that the 14 presymptomatic children in our study had a slightly higher median viral load (7.7×10^4 [1.1×10^2 to 2.4×10^6]) than those who did not develop symptoms, but the viral loads in these presymptomatic children were still relatively low. Many patients in our study did not have data available regarding contacts or subsequent symptoms, and data from a larger cohort of presymptomatic children (perhaps from dedicated contact tracing programs) will be necessary to fully elucidate the range of viral burdens in these children; in particular, it will be critical to define the peak viral load in asymptomatic and presymptomatic children to clarify diagnostic test options in this population. We note that even in the asymptomatic surveillance subcohort with highest viral loads, median viral loads were still significantly lower than in the symptomatic cohort. Seventy-five percent of these asymptomatic subjects had viral loads less than 1.2×10^7 copies/ml (and for those with recent contacts, 75% had less than 1.8×10^6 copies/ml), which has implications for assay selection if the goal is to capture all positive patients under the assumption that patients with any viral load can potentially transmit; in the preprocedure and preadmission groups, almost all viral loads are likely below the limits of detection of available rapid antigen tests (estimated at 1×10^6 copies/ml based on information in package inserts). Additional studies will also be necessary to determine the extent to which individuals of any age are able to transmit infection at low viral loads.

We do not believe that the stage of outbreak impacted our findings because we included patients from centers across the country, and we matched symptomatic and asymptomatic patients by time of testing; similar results were observed at each institution. We may have slightly biased our symptomatic population toward more severe disease by requiring that each patient have a minimum of 2 symptoms of COVID, but we did this in order to maximize the likelihood that symptoms were truly caused by SARS-CoV-2.

Our methods of combining and comparing data across institutions also have limitations.

Our conversion of Ct to viral load for each assay was done based either on standard curves performed by the laboratory or manufacturer or on data in package inserts. We normalized Ct values from each assay to median values for all symptomatic patients (0 to 17 years) from that institution tested by that assay to be able to make an optimal comparison across institutions and assays. Importantly, we compared asymptomatic to symptomatic cohorts both by adjusted Ct value and by estimated viral load and obtained similar results, indicating that these limitations were effectively mitigated. Finally, we note that these limitations apply equally to both asymptomatic and symptomatic cohorts from each institution and thus should not affect the comparison of those cohorts.

Conclusions. Our findings that viral loads in asymptomatic children diagnosed with SARS-CoV-2 infection by hospital testing programs are significantly lower than those in symptomatic children may provide some level of reassurance about returning to daycare and school with proper safety measures (masks, hygiene, distancing, and ventilation) in place and rigorous exclusion of symptomatic children from the school setting. However, the observation that all age brackets of asymptomatic kids include outliers with low Ct values/high viral loads and our imperfect ability to predict who these outliers will be indicate that safety precautions for daycare centers and schools are indeed necessary. Our data underscore that the timing of diagnostic testing relative to initial infection impacts viral burden and that peak viral loads in asymptomatic children remain to be defined in future studies. Regardless, the lower viral loads in the asymptomatic children in our study should raise caution about using low-sensitivity tests for asymptomatic screening programs in pediatric populations.

SUPPLEMENTAL MATERIAL

Supplemental material is available online only.

SUPPLEMENTAL FILE 1, PDF file, 0.4 MB.

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N.R.P. and L.K.K. had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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