

Coronavirus Disease 2019 Mitigation Strategies Were Associated With Decreases in Other Respiratory Virus Infections

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Detection of diverse respiratory viruses in Boston was approximately 80% lower after practices were instituted to limit coronavirus disease 2019 (COVID-19) spread compared with the same time period during the previous 5 years. Continuing the strategies that lower COVID-19 dissemination may be useful in decreasing the incidence of other viral respiratory infections.

Keywords. COVID-19; mitigation strategies; respiratory viral infections; SARS-CoV-2; transmission.

After severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), the causative agent for coronavirus disease 2019 (COVID-19), was declared a pandemic, physical distancing, mask wearing, and other behavioral changes were adopted to limit virus transmission in the city of Boston [1]. Given that other common viral respiratory pathogens are also transmitted via aerosols, droplets, or contact, it is tenable that these measures may have reduced rates of infection by viruses other than SARS-CoV-2 [2]. In this brief report, we assess the impact of strategies aimed at decreasing SARS-CoV-2 spread on other respiratory viral infections.

METHODS

Study Design

We performed a retrospective cohort analysis to compare respiratory viral infections other than SARS-CoV-2 in 2020 to corresponding periods in the previous 5 years.

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Data Collection

Similar to our previous investigation, we collected all documented respiratory virus infections on a comprehensive respiratory panel polymerase chain reaction ([CRP-PCR] BioFire Diagnostics) test at Boston Medical Center (BMC) from January 1, 2015 to November 25, 2020 [3]. The CRP-PCR detects nucleic acids for 20 common respiratory pathogens. We used a positive CRP-PCR test as a surrogate marker for viral infection. We excluded SARS-CoV-2 test results—positive or negative—because this analysis focused on the incidence of respiratory viruses commonly circulating before the COVID-19 pandemic. We also obtained the patient age and level of medical care (inpatient, observation unit, emergency room, or outpatient) associated with each CRP-PCR test.

Descriptive Statistics

Coronavirus disease 2019 mitigation practices started after March 10, 2020 (week 11), and data collection stopped on November 25, 2020 (week 47). Each year was divided into 2 periods: period 1 (weeks 1–10) and period 2 (weeks 12–46). Therefore, in 2020, period 1 corresponded to the phase before institution of COVID-19 mitigation practices. Age groups (less than 18, 18 to 65, and greater than 65 years of age) and level of medical care (hospital-based or ambulatory) were compared using χ^2 tests. Weekly viral testing data in the two 2020 periods were compared with the median for the corresponding weeks from the previous 5 years using matched-pairs Wilcoxon rank-sum test.

Multivariable Analysis

We calculated adjusted odds ratio (aOR) of viral detection per CRP-PCR test in period 1 and period 2 of 2020 relative to the corresponding periods of the previous 5 years. In this multivariable binary logistic regression analysis, CRP-PCR tests with or without a detected respiratory virus was the dependent variable, and the year (2020 or 2015–2019), continuous age in years, and level of care (inpatient versus outpatient) were the independent variables. This analysis was conducted independently for the 2 periods. All *P* values represent 2-sided tests. Statistical analyses were performed in SPSS, version 26.0 (IBM, Armonk, NY).

Patient Consent Statement

The design of the work was approved by the Boston University Institutional Review Board. No written consent was obtained from patients.

RESULTS

During period 1 (3397 in 2020; range from 1388 to 2719 in 2015–2019) and period 2 (6976 in 2020; range from 2285 to 4977 in 2015–2019), the number of CRP-PCR tests was higher in 2020 compared to any of the previous 5 years (Table 1). The number of unique patients evaluated with a CRP-PCR was also higher in 2020 (period 1, 3113; period 2, 5939) than any of the 2015 to 2019 years (period 1, range 1268–2469; period 2, range 2010–4250). In 2020 period 2, pediatric patients (age <18 years) were less frequently assessed with a CRP-PCR ($P < .0001$), and CRP-PCR tests were more frequently ordered while patients were at a hospital (inpatient, observation unit, or emergency department) rather than an ambulatory setting ($P < .0001$) (Table 1). In contrast, CRP-PCR assessment was less frequent among older patients (age >65 years, $P = .009$) and those at a hospital ($P < .0001$) in 2020 period 1 compared to the previous 5 years. Thus, demographics and the care setting differed among the patients evaluated with a CRP-PCR test in 2020 period 2 compared to the previous 5 years.

In period 2, the cumulative number of detected viruses per week was significantly lower in 2020 (Table 1 and Supplementary Figure 1). Regardless of the suspected predominant route of transmission, decreases were observed for all the different respiratory viruses (influenza, parainfluenza viruses,

metapneumoviruses, adenovirus, coronaviruses, enteroviruses, and respiratory syncytial virus) detected with a CRP-PCR test. The total number of viruses detected relative to the number of CRP-PCR tests was approximately 80% lower in 2020 period 2 compared to the previous 5 years (Supplementary Figure 1B).

Cumulative virus detection began to increase at approximately week 30, which temporally coincides with the phased “reopening” in Boston on July 20, 2020 (Supplementary Figure 1A) [1]. Similar to a previous investigation, there was a rise in rhinovirus infections approximately 2 to 3 weeks after the phased reopening [4]. There was no difference in the cumulative number of rhinovirus infections from week 33 to week 47 in 2020 compared to the corresponding weekly median from 2015 to 2019 ($P = .48$, Wilcoxon matched-pairs signed-rank test). Nonetheless, the cumulative number of detected viruses and the cumulative number of viruses relative to the number of CRP-PCR tests between week 30 to week 46 remained lower in 2020 compared with previous 5 years (Supplementary Figure 1), although the difference was smaller compared with week 12 to week 29 (Supplementary Figure 2).

In multivariable logistic regression analysis, the odds of detecting a respiratory virus per test was significantly lower (aOR, 0.16; 95% confidence interval [CI], 0.15–0.18) in 2020 period 2 after adjusting for the level of medical care and patient

Table 1. CRP-PCR tests, patient demographics, and viruses detected

Characteristics	Period 1 (Week 1–Week 10)			Period 2 (Week 12–Week 46)		
	2015–2019 Range	2020 No.	<i>P</i> value	2015–2019 range	2020 No.	<i>P</i> value
# CRP-PCR tests	1388–2719	3397		2285–4977	6976	
# unique patients	1268–2469	3112		2010–4250	5939	
Age (%)^a						
<18	316–614 (24–26)	825 (27)	.009	498–1007 (20–24)	553 (9)	<.0001
18–65	623–1298 (49–54)	1692 (54)		1087–2318 (54–56)	4016 (68)	
>65	257–614 (20–26)	595 (19)		425–925 (21–24)	1370 (23)	
Level of Medical Care (%)^a						
Hospital	1289–2347 (85–93)	2674 (79)	<.0001	2175–4496 (91–95)	6729 (97)	<.0001
Ambulatory	103–380 (7–15)	695 (21)		108–463 (5–9)	229 (3)	
CRP-PCR results/week^b						
Total # viruses detected per week	93.5 (23–214)	166 (113–257)	.005	38 (2–148)	14.5 (0–91)	<.001
Influenza	34 (0–97)	76.5(28–139)	.005	0.5 (0–56)	0.0 (0–13)	.001
Parainfluenza	2 (0–10)	3.5 (0–5)	.365	4 (0–18)	0 (0–5)	<.001
Metapneumovirus	6 (0–17)	10 (5–18)	.009	1 (0–21)	0 (0–10)	<.001
Adenovirus	4 (0–15)	6.5 (3–11)	.005	2 (0–14)	1 (0–10)	.006
Coronavirus	18.5 (1–45)	22.5 (13–43)	.005	1 (0–12)	0 (0–15)	.001
Enterovirus	15 (4–39)	30.5 (16–46)	.005	21 (0–56)	9.5 (0–37)	<.001
Respiratory syncytial virus	18 (4–42)	26.5 (3–42)	.028	1 (0–20)	0 (0–5)	<.001
Total # viruses detected/# of tests	0.54 (0.26–0.71)	0.53 (0.43–0.65)	.114	0.38 (0.11–0.58)	0.07 (0.00–0.26)	<.001
Multivariable Logistic Regression Adjusted Odds Ratio^c						
Viral detection per test		1.06 (0.98–1.14)	.16		0.16 (0.15–0.18)	<.001

Abbreviations: CI, confidence interval; CRP-PCR, comprehensive respiratory panel polymerase chain reaction.

^a χ^2 test comparing 2015–2019 median to 2020.

^bWilcoxon rank sum matched pair analysis with 2020 weeks matched to the median value from 2015 to 2019 weeks.

^cAdjusted odds ratio calculated through binary logistic regression with age and level of care as covariates. 95% Confidence interval in brackets.

age. The number of each pathogen detected, except for parainfluenza virus, was higher, in 2020 period 1 compared to the period 1 for 2015 to 2019 (Table 1). However, there was no difference in the proportion of CRP-PCR tests that was positive for viral pathogens in 2020 period 1 compared to the corresponding period in 2015 to 2019. The odds of detecting a respiratory virus per test in period 1 (aOR, 1.06; 95% CI, 0.98–1.14) was not different in 2020 compared to 2015 to 2019 after adjusting for the level of medical care and patient age.

DISCUSSION

Previous studies have suggested that community-level strategies used to halt the spread of SARS-CoV-2 lowered influenza transmission [5–8]. These previous investigations have not provided community level patient data for other respiratory viruses in the United States. Our observations argue that COVID-19 mitigation strategies were effective in decreasing commonly circulating respiratory virus transmission independent of seasonal variation. Viral infections were not lower in 2020 period 1, which predated the institution of the precautions, and thus the cumulative decrease in viruses detected in 2020 period 2 was unlikely due to differences in testing volume, the types of patients evaluated, or their level of medical care. It is interesting to note that an increase in cumulative virus detection, especially rhinovirus, was temporally associated with the “phased reopening” of Boston at approximately week 30. Thus, institution and relaxing of COVID-19 community efforts and individual behaviors was associated with a significant decrease and subsequent increase in respiratory virus diagnoses.

CONCLUSIONS

This study has limitations. It is associative and does not prove causation. Furthermore, our data are based on results available at BMC only, and they may not generalize to other settings. Although a positive test on the CRP-PCR likely indicates active rather than a prior infection, detection of certain viruses may reflect asymptomatic carriage. In addition, differences in detection of individual viruses should be interpreted cautiously because this study may not have been powered to detect a difference. Our study also cannot determine which practice, such as mask wearing, physical distancing, school closures, or others, was primarily associated with the observed decrease in cumulative virus detection. Although this study design cannot establish causality, our findings are useful because they suggest that continued vigilance in slowing SARS-CoV-2 spread may

also ameliorate the impact from other respiratory pathogens, reducing the strain on healthcare infrastructure. Even once the pandemic resolves, practices implemented to reduce COVID-19 transmission may be advisable for vulnerable individuals such as the elderly or the immunocompromised, particularly in high-risk settings such as nursing homes, assisted living facilities, entertainment venues, or during travel, especially during the winter months at the annual peak of most respiratory viral infections. Furthermore, our analysis provides an estimate for the impact of the combined community and personal practices on viral infections, which is important for making public health decisions, developing mathematical models, and cost-effectiveness analyses.

Supplementary Data

Supplementary materials are available at Open Forum Infectious Diseases online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

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