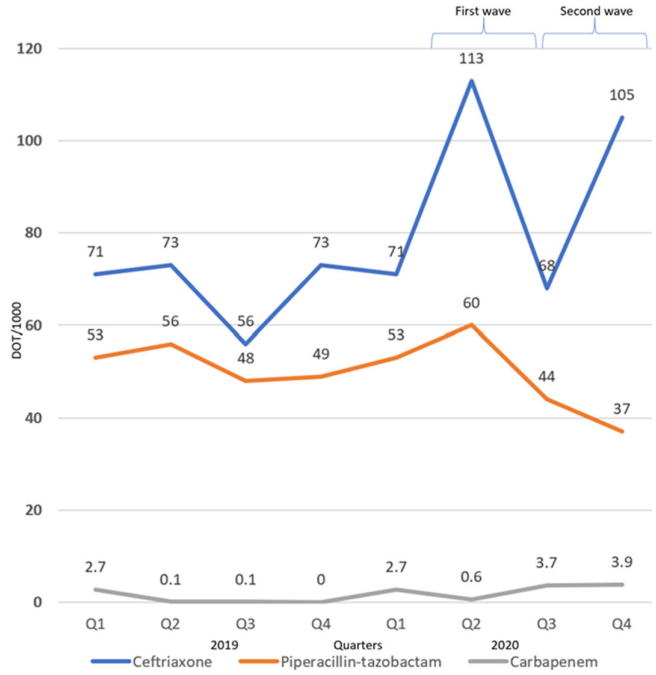

Figure 1. DOT per 1,000 PD by quarter (Q1–Q4) during the first and second waves of COVID-19.

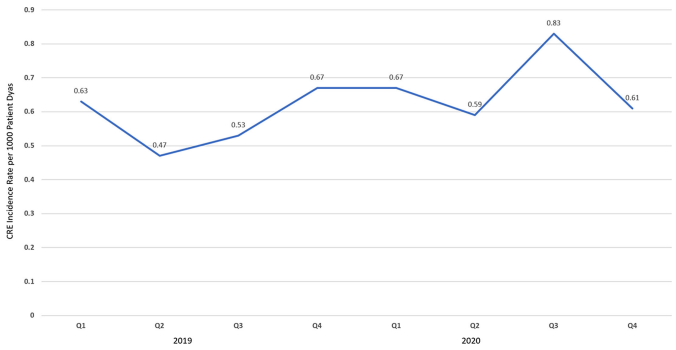

Figure 1. CRE infection incidence rate per 1,000 patient days.

unprecedented public health crisis. Lower respiratory tract infections (LRTIs) and hypoxia caused by COVID-19 has led to an increase in hospitalizations. We sought to define the impact of COVID-19 on antimicrobial use and antimicrobial resistance (AMR) in an urban safety-net community hospital. **Methods:** Retrospective review of antimicrobial use and AMR in a 151-bed urban community hospital. Antimicrobial use was calculated in days of therapy per 1,000 patient days (DOT/1,000 PD) for ceftriaxone, piperacillin-tazobactam and meropenem during 2019 and 2020. Ceftriaxone, piperacillin-tazobactam and meropenem were reviewed for calendar year 2019 and 2020. AMR was assessed by comparing the carbapenem resistant Enterobacteriaceae (CRE) infection incidence rate per 1,000 patient days between 2019 and 2020. **Results:** The average quarterly DOT/1,000 PD increased from 359.5 in 2019 to 394.25 in 2020, with the highest increase in the second and fourth quarters of 2020, which temporarily correspond to the first and second waves of COVID-19. Ceftriaxone and meropenem use increased during the first and second waves of COVID-19. Piperacillin-tazobactam use increased during the first wave and declined thereafter (Figure 1). Rates of CRE increased from a quarterly average of 0.57 to 0.68 (Figure 2). **Conclusions:** Antimicrobial pressure increased during the first and second waves of COVID-19. Ceftriaxone was the most commonly used antimicrobial, reflecting internal guidelines and ASP interventions. CRE rates increased during COVID-19. This finding may be due to an overall increase in antimicrobial pressure in the community and in critically ill patients. Antibiotics are a precious resource, and antimicrobial stewardship remains important during the COVID-19 pandemic. Appropriate use of antimicrobials is critical to preventing AMR.

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Sociodemographic Factors, Cycle Threshold Values, and Clinical Outcomes of COVID-19

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Background: The gold standard for diagnosis of COVID-19 has been SARS-CoV-2 detection by reverse-transcriptase-quantitative polymerase chain reaction (RT-qPCR), which provides a semiquantitative indicator of viral load (cycle threshold, Ct). Our research group previously described how African American race and poverty were associated with an increased likelihood of hospitalization due to COVID-19. We sought to characterize the relationship between Ct values and clinical outcomes while controlling for sociodemographic factors. **Methods:** We conducted a cross-sectional study of SARS-CoV-2–positive patients admitted to Froedtert Health between March 16 and June 1, 2020. Ct values were obtained by direct interrogation of either cobas SARS-CoV-2 or Cepheid Xpert Xpress platforms. Patient demographics, comorbidities, symptoms at admission, health insurance, and hospital course were collected using electronic medical records. A proxy for socioeconomic disadvantage, area-deprivation index (ADI), was assigned using ZIP codes. Multivariate models were performed to assess associations between Ct values and clinical outcomes while controlling for ADI, race, and type of insurance. **Results:** Overall, 302 patients were included. The mean age was 60.89 years (SD, 18.2); 161 (53%) were men, 177 (58%) were African Americans; and 156 (51%) had Medicaid or were uninsured. Of the 302 inpatients, 158 (52%) required admission to the ICU, 199 (65.9%) were discharged to home, 49 (16.2%) were discharged to a nursing home, and 54 (17.9%) died. Lower Ct values (higher viral load) were associated with Medicaid or lack of insurance (coefficient, −2.88, 95% confidence interval [CI], −4.96 to −0.79, $P = .007$) and age >60 years old (coefficient, −2.98, 95% CI −4.87 to −1.08, $P = .002$). Contrary to what was expected, higher CT values (lower viral load) were associated with higher ADI scores (coefficient, 2.62, 95% CI, 0.52–4.85; $P = .017$). However, when patients were stratified into low, medium, and high

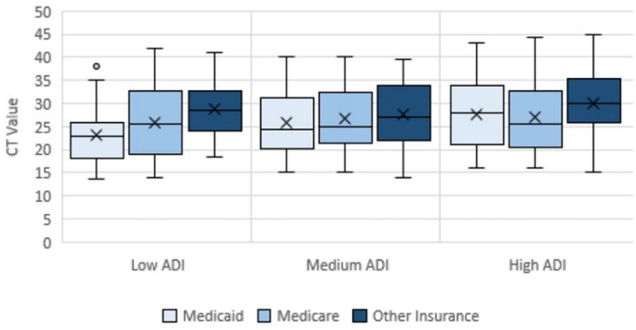

Figure 1: Cycle Threshold (CT) Value Distribution by Patient Insurance Type stratified by Area Depravation Index (ADI). Medicaid group includes no insurance. High ADI is worse. Higher CT values represent lower viral loads and vice versa.

ADI, those with Medicaid or no insurance had the lowest mean Ct values (23.3, 25.9, and 27.6, respectively) compared to Medicare or other insurance (Figure 1). Body mass index (odds ratio [OR], 1.04; 95% CI, 1.02–1.07; P = .001) and male sex (OR, 2.15; 95% CI, 1.28–3.60; P = .004) were independently associated with ICU admission. Every increase of a CT point (OR, 0.90; 95% CI, 0.85–0.95; p <0.001) and age >60 years old (OR 2.62, 95% CI; 1.14-6.04; p=0.023) was associated with death. **Conclusions:** In this cross-sectional study of adults tested for COVID-19 in a large midwestern academic health system, lower Ct values were independently associated with poverty and age >60 years old.

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Suspected COVID-19 Reinfections at a Tertiary Care Center, Iowa 2020

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Background: Coronavirus disease 2019 (COVID-19) is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). SARS-CoV-2 RNA can be detected by real-time reverse-transcription polymerase chain reaction (RT-PCR) for several weeks after infection. Discerning persistent RT-PCR positivity versus reinfection is challenging and the frequency of COVID-19 reinfections is unknown. We aimed to determine the frequency of clinically suspected reinfection in our center and confirm reinfection using viral whole-genome sequencing (WGS). **Methods:** The University of Iowa Hospitals and Clinics (UIHC) is an 811-bed academic medical center. Patients with respiratory complaints undergo COVID-19 RT-PCR using nasopharyngeal swabs. The RT-PCR (TaqPath COVID-19 Combo kit) uses 3 targets (ORF1ab, S gene, and N gene). We identified patients with previous laboratory-confirmed COVID-19 who sought care for new respiratory complaints and underwent a repeated SARS-CoV-2 test at least 45 days from their first positive test. We then identified patients with median RT-PCR cycle threshold (Ct) values. **Results:** During the study period, 13,603 patients had a SARS-CoV-2– positive RT-PCR. Of these, 296 (2.2%) had a clinical visit for new onset of symptoms and a repeated RT-PCR assay >45 days from the first test. Moreover, 29 patients (9.8%) had a positive RT-PCR assay in the repeated testing. Ct values were available for samples from 25 patients; 7 (28%) had Ct values. **Conclusions:** In patients with a recent history of COVID-19 infection, repeated testing for respiratory symptoms was infrequent. Some had a SARS-CoV-2–positive RT-PCR assay on repeated testing, but only 1 in 4 had Ct values suggestive of a reinfection. We confirmed 1 case of reinfection using WGS.

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Evaluating the Relationship between Cycle Threshold Values and Reported COVID-19 Symptoms among Healthcare Workers

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Background: SARS-CoV-2 detected by reverse transcription polymerase chain reaction (RT-PCR) can persist for weeks to months in some individuals. Cycle threshold (Ct) values represent the number of cycles needed to amplify viral ribonucleic acid (RNA) to reach a detectable level. As such, Ct values are inversely related to the amount of virus in a sample. As knowledge of SARS-CoV-2 viral dynamics continues to evolve, understanding the relationship between Ct values, type of symptoms, and timing of symptom onset can help determine when infected individuals are most likely to be infectious. **Methods:** We conducted a retrospective cohort study of 1,027 healthcare workers (HCWs) who tested positive for SARS-CoV-2 by RT-PCR from nasopharyngeal specimens between June 27, 2020, and September 21, 2020. All HCWs were interviewed within 72 hours of their diagnosis for symptom history. Due to multiple PCR platforms being in use in our facility, only 360 HCWs (35%) had Ct values available for analysis. Multivariate linear regression models examined the effect of COVID-19–related symptoms and timing of symptom onset to test on Ct values. **Results:** The most frequently reported symptoms were congestion (55.6%), cough (50.3%), and headache (46.7%). Other symptoms less commonly reported were fatigue (36.7%), loss of taste or smell (36.4%), fever (35.4%), muscle aches (33.3%), sore throat (27.4%), and diarrhea (26.7%). Symptomatic HCWs (88.3% of sample) had lower Ct values (ORF-1 M = 22.66, SD = 5.17; E-Gene M = 24.34, SD = 6.60) than asymptomatic individuals (ORF-1 M = 25.46, SD = 6.06; E-Gene M = 29.34, SD = 7.96). Of all symptoms measured, only presence of fever, congestion, and muscle aches predicted significantly lower Ct values. Mean Ct values decreased 2 days prior to symptom onset, were lowest the day of symptom onset, then increased in a curvilinear fashion. There were no significant 2-way interactions between symptoms and time of symptom onset to testing. **Conclusions:** The curvilinear pattern of Ct values over time from symptom onset are consistent with disease progression patterns and support current understanding of infectivity being highest 2 days prior to symptom onset through day 8. Presence of fever, congestion, and muscle aches are significantly correlated with lower Ct values, suggesting that these symptoms are associated with higher viral load. Although Ct values are not without limitations, our findings support the current understanding that presymptomatic and symptomatic individuals, particularly those with fever, congestion, and muscle aches, may pose higher risk of transmission to others.

Table 1: Linear regression modeling of the effect of symptoms associated with COVID-19 on CT values

	E-Gene CT Value	ORF 1 CT Value
Model 1 Intercept (CI)	28.72	25.67
	(25.65 - 31.79)	(23.10 - 28.25)
Symptomatic β (CI)	-0.31***	-0.22***
	(-9.28 - -4.63)	(-6.13 - 1.99)
Linear days from Symptom Onset to Test	0.23***	0.28***
	(0.26 - 0.68)	(0.26 - 0.61)
Model 2 Intercept (CI)	26.38	23.96
	(23.64 – 29.12)	(21.75 - 26.17)
Sore Throat	-0.001	-0.01
	(-1.65 - 1.62)	(-1.48 - 1.15)
Headache	-0.06	-0.37
	(-2.34 - 0.68)	(-1.43 - 1.15)
Fever	-0.12*	-0.13*
	(-3.32 - -0.21)	(-2.68 - -0.23)
Loss of Taste/Smell	-0.06	0.03
	(-2.39 – 0.71)	(-0.93 - 1.52)
Chest Tightness	-0.03	-0.02
	(-2.81 – 1.45)	(-1.97 - 1.41)
Cough	-0.01	0.04
	(-1.71 – 1.44)	(-0.83 - 1.63)
Congestion	-0.16**	-0.13*
	(-3.83 - -0.73)	(-2.58 - -0.11)
Gastrointestinal Discomfort	0.04	0.02
	(-1.15 – 2.27)	(-1.20 - 1.55)
Muscle Aches	-0.17**	-0.21***
	(-4.23 - -0.90)	(-3.68 - -1.01)
Fatigue	-0.07	-0.01
	(-2.57 – 0.59)	(-1.31 - 1.20)
Linear days from Symptom Onset to Test	0.19**	0.24***
	(0.18 - 0.60)	(0.20 - 0.54)
Curvilinear days from Symptom Onset to Test	0.28*	0.31*
	(0.01 – 0.09)	(0.01 – 0.09)

Cell values are standardized beta coefficients and 95% confidence intervals in parentheses. Models were adjusted for sex and age. The curvilinear effect of time on CT values was nonsignificant in the asymptomatic model. *** p < .001, ** p < .01, * p < .05