



Gastrointestinal Manifestations of COVID-19 Across the United States: A Multi-Center Cohort Study



Ankur Patel, BA¹, Troy Sanders, BS¹, Sujay Alencar, MD², Alyssa Choi, MD³, Jade Law, MD⁴, Janaki Shah, MD⁵, Karishma Patel, BA⁶, Michelle Nguyen, BS², Taliha Yasin, MD³, Daniel Kim, MD³, Preeti Prakash, MD⁷, Tahnee Sidhu, MD⁸, Padmavathi Srivoleti, MD⁸, Kirtan Chauhan, MD⁹, Simcha Weissman, MD¹⁰, Erik Holzwanger, MD², Rohit Dhingra, MD², Aaron Dickstein, MD², Nimisha Parekh, MD³, James Tabibian, MD⁴, Osama Altayar, MD⁵, Matthew Ciorba, MD⁵, Jessica Yu, MD⁶, Lea Ann Chen, MD¹¹, Liu Yang, MD⁷, Berkeley Limketkai, MD⁷

1. David Geffen School of Medicine at UCLA, 2. Tufts Medical Center, 3. University of California, Irvine, 4. UCLA Medical Center Olive View, 5. Washington University in St. Louis, 6. Oregon Health & Science University, 7. University of California, Los Angeles, 8. Saint Elizabeth's Medical Center, 9. NYU Langone Health, 10. Hackensack University Medical Center, 11. Rutgers University

Learning Objectives

- Aim 1. To characterize GI and hepatobiliary manifestations of COVID-19 among hospitalized patients in the United States.
- Aim 2. To compare characteristics of GI and hepatobiliary manifestations of COVID-19 between geographic regions.

Background

Coronavirus disease 2019 (COVID-19) has infected over 14 million people in the United States (US) as of December 1, 2020. Recent data have shown that COVID-19 strains appear to demonstrate geographic variation, such as Asian strains predominating in the Western US and European strains predominating in the Eastern US. However, the clinical significance of this variation remains unclear. In this large, multi-center cohort study, we evaluated gastrointestinal (GI) manifestations of COVID-19 regionally and throughout the US.

Methods

Patients hospitalized with a positive COVID-19 test were identified at seven US academic centers. As a surrogate for differing COVID-19 strains, patients were stratified into regions (West, Midwest, or Northeast) depending on hospital location. Demographics, presenting symptoms, laboratory data, and hospitalization outcomes were abstracted. Statistical comparisons were performed with Chi-square and ANOVA tests, as appropriate.

Tables

	Total	West	Midwest	Northeast
Total Patients (N)	1896	1300	120	476
Age (Mean ± SD)	58.1 ± 19.1	56.6 ± 19.5	63.0 ± 17.0	61.0 ± 18.0
BMI (Mean ± SD)	29.9 ± 8.4	30.3 ± 8.4	31.1 ± 9.9	28.9 ± 7.7
Sex (N, %)				
Male	1065 (56.8%)	719 (56.3%)	70 (58.3%)	276 (58.0%)
Female	809 (43.2%)	559 (43.7%)	50 (41.7%)	200 (42.0%)
Race (N, %)				
Caucasian	768 (40.5%)	520 (40.0%)	9 (7.5%)	239 (50.2%)
Asian	151 (8.0%)	87 (6.7%)	1 (0.8%)	63 (13.2%)
African American	170 (9.0%)	70 (5.4%)	16 (13.3%)	84 (17.6%)
Hispanic	435 (22.9%)	350 (26.9%)	9 (7.5%)	76 (16.0%)
Other	301 (15.9%)	224 (17.2%)	0 (0.0%)	67 (14.1%)
Unknown	151 (8.0%)	34 (2.6%)	94 (78.3%)	23 (4.8%)
COVID-19 Exposure (N, %)				
Travel History	74 (3.9%)	59 (4.5%)	2 (1.7%)	13 (2.7%)
Known COVID-19+ Contact	480 (25.3%)	306 (23.5%)	43 (35.8%)	131 (27.5%)
Presenting Symptoms (Mean ± SD or N, %)				
Temperature (°C)	37.3 ± 1.2	37.3 ± 1.3	37.4 ± 1.0	37.3 ± 1.0
Fever	675 (43.7%)	371 (39.2%)	47 (39.2%)	257 (54.0%)
Cough	875 (46.1%)	592 (45.5%)	59 (49.2%)	224 (47.1%)
Dyspnea	914 (48.2%)	588 (45.2%)	67 (55.8%)	259 (54.4%)
Average WBC x10 ⁹ /L (Mean ± SD)	8.3 ± 4.9	8.2 ± 5.0	8.4 ± 5.3	8.5 ± 4.7

Table 1. Demographic and Clinical Data of Patients with COVID-19 by Geographic Region.

	Total	West	Midwest	Northeast	p-value
Total Patients (N)	1896	1300	120	476	
Gastrointestinal Symptoms (N, %)					
Overall	385 (20.3%)	231 (17.8%)	32 (26.7%)	122 (25.6%)	<0.01
Abdominal Pain	92 (6.0%)	49 (5.2%)	4 (3.3%)	39 (8.2%)	<0.01
Nausea/Vomiting	196 (10.3%)	126 (9.7%)	15 (12.5%)	55 (11.6%)	<0.01
Diarrhea	235 (12.4%)	138 (10.6%)	21 (17.5%)	76 (16.0%)	<0.01
AST (Mean ± SD or N, %)					
Mean (U/L)	61.3 ± 126.6	54.4 ± 66.2	89.7 ± 151.7	63.2 ± 172.7	<0.01
Normal (< 40 U/L)	598 (52.8%)	322 (54.9%)	44 (38.3%)	232 (53.8%)	<0.01
Mildly elevated (> 40 U/L, < 100 U/L)	410 (36.2%)	214 (36.5%)	44 (38.3%)	152 (35.3%)	0.82
Moderately elevated (> 100 U/L)	124 (11.0%)	50 (8.5%)	27 (23.5%)	47 (10.9%)	<0.01
Peak (U/L)	3384	1048	1472	3384	
ALT (Mean ± SD or N, %)					
Mean (U/L)	46.1 ± 68.2	47.2 ± 61.9	56.1 ± 126.0	41.9 ± 53.0	0.26
Normal (< 40 U/L)	761 (66.8%)	379 (63.8%)	76 (66.1%)	306 (71.2%)	0.047
Mildly elevated (> 40 U/L, < 100 U/L)	283 (24.8%)	169 (28.5%)	24 (20.9%)	90 (20.9%)	0.01
Moderately elevated (> 100 U/L)	95 (8.3%)	46 (7.7%)	15 (13.0%)	34 (7.9%)	0.16
Peak (U/L)	1274	976	1274	534	
Total bilirubin (Mean ± SD or N, %)					
Mean (mg/dL)	0.81 ± 1.47	0.94 ± 1.85	0.64 ± 0.52	0.69 ± .098	<0.01
Normal (< 1.2 mg/dL)	992 (89.0%)	493 (86.6%)	105 (92.1%)	394 (91.4%)	0.03
Mildly elevated (> 1.2 mg/dL, < 3 mg/dL)	102 (9.2%)	65 (11.4%)	8 (7.0%)	29 (6.7%)	0.03
Moderately elevated (> 3 mg/dL)	20 (1.8%)	11 (1.9%)	1 (0.9%)	8 (1.9%)	0.74
Peak (mg/dL)	54	54	4.5	13	
Complications (N, %)					
Gastrointestinal Hemorrhage	56 (3.0%)	19 (1.5%)	4 (3.3%)	33 (6.9%)	0.03
Pancreatitis	12 (0.6%)	3 (0.2%)	2 (1.7%)	7 (1.5%)	<0.01
ICU Admission	730 (38.5%)	442 (34.0%)	56 (46.7%)	232 (48.7%)	<0.01
Outcome (N, %)					
Alive	1606 (84.7%)	1113 (84.7%)	103 (85.8%)	390 (81.9%)	0.15
Dead	217 (11.4%)	120 (9.2%)	17 (14.2%)	80 (16.8%)	<0.01
Unknown	73 (3.9%)	67 (5.2%)	0 (0.0%)	6 (1.3%)	<0.01

Table 2. Gastrointestinal Manifestations of COVID-19 in Patients by Geographic Region.

Results

A total of 1896 patients were identified (Table 1). Most patients were male (56.8%), and the most prevalent race was Caucasian (40.5%). The mean age was 58.1 years (±19.1), and the mean body mass index (BMI) was 29.9 (±8.4). A third (29.2%) of patients had a known COVID-19 exposure. The mean presenting temperature was 37.3 °C, and dyspnea was the most common presenting symptom (48.2%). GI symptoms were present in 20.3% of the overall cohort (Table 2); diarrhea was most common (12.4%), followed by nausea and/or vomiting (10.3%) and abdominal pain (6.0%). Geographically, GI symptoms were significantly less common in the Western cohort (17.8%) than the Northeastern (25.6%) and Midwestern (26.7%) cohorts. GI complications (GI hemorrhage and pancreatitis) were also significantly less common in the Western cohort (1.5%, 0.2%) than the Northeastern (6.9%, 1.5%) and Midwestern (3.3%, 1.7%) cohorts. The Midwestern cohort had a higher prevalence of moderately elevated serum aspartate aminotransferase (AST; 23.5% vs 8.5% in Western and 10.5% in Northeastern cohorts; p<0.01). Compared to the Northeastern and Midwestern cohorts, the Western cohort had a higher prevalence of mildly elevated serum alanine aminotransferase (ALT; 20.9% and 20.9% vs 28.5%; p=0.01) and total bilirubin (6.7% and 7.0% vs 11.4%; p=0.03). The presence of GI symptoms was not associated with increased mortality (p=0.15).

Limitations

- Some institutions were working on different databases, data points may have been reported in different ways, and some data that was not collected at some institutions may not be reflected in the results.
- There may have been under-reporting of GI symptoms in patients who were primarily experiencing respiratory symptoms. Thus, symptom tracking may have varied between patients as well as note writers.
- The majority of data was collected from early cohorts of patients, and may not reflect the impact of more recent treatment methods.

Conclusion

Although GI manifestations were common among patients hospitalized with COVID-19, there is significant variability in prevalence across the US. GI symptoms and complications were less common in the West than the Northeast or Midwest. Our study highlights notable geographic variations in GI manifestations of COVID-19, prompting the need for further investigation into the mechanisms of these differences. Such insight could identify strategies that mitigate GI complications of COVID-19 infection.