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COVID-19 Pandemic and the Cholecystitis Experience at a Major Urban Safety-Net Hospital

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ABSTRACT

Background: Acute cholecystitis is a common reason for emergency general surgery admission. The declaration of the COVID-19 pandemic may have resulted in treatment delays and corresponding increases in severity of disease. This study compared cholecystitis admissions and disease severity pre- and postdeclaration of pandemic.

Materials and Methods: Retrospective review of adult acute cholecystitis admissions (January 1,2020-May 31, 2020). Corresponding time periods in 2018 and 2019 comprised the historical control. Difference-in-differences analysis compared biweekly cholecystitis admissions pre- and postdeclaration in 2020 to the historical control. Odds of increased severity of disease presentation were assessed using multivariable logistic regression.

Results: Cholecystitis admissions decreased 48.7% from 5.2 to 2.67 cases (RR 0.51 [0.28,0.96], $P = 0.04$) following pandemic declaration when comparing 2020 to historical control ($P = 0.02$). After stratifying by severity, only Tokyo I admissions declined significantly postdeclaration (RR 0.42 [0.18,0.97]), when compared to historical control ($P = 0.02$). There was no change in odds of presenting with severe disease after the pandemic declaration (aOR 1.00 [95% CI 0.30, 3.38] $P < 0.99$) despite significantly longer lengths of symptoms reported in mild cases.

Conclusions: Postpandemic declaration we experienced a significant decrease in cholecystitis admissions without corresponding increases in disease severity. The pandemic impacted healthcare-seeking behaviors, with fewer mild presentations. Given that the pandemic did not increase odds of presenting with increased severity of disease, our data suggests that not all mild cases of cholecystitis progress to worsening disease and some may resolve without medical or surgical intervention.

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Introduction

The World Health Organization (WHO) officially declared COVID-19 a pandemic on March 11, 2020. At the peak of the pandemic, Massachusetts ranked third in the United States for total cases of COVID-19.[1] Our institution, an academic safety-net hospital, cares for a diverse patient population within the city of Boston and has been impacted disproportionately by the COVID-19 pandemic. In April 2020, 7 out of every 10 patients admitted to our institution tested positive for COVID-19.[2] The pandemic led to rapid and drastic changes in health systems. An overwhelming patient burden and limited beds forced hospitals to expand their ICU capacity.[3] Physician groups and health systems grew their telemedicine services exponentially to meet increasing patient needs, but with regulations to postpone elective operations, many surgical patients went without their planned procedures.[4] It is estimated that over 28 million elective operations were cancelled or postponed during the peak 12-weeks of the COVID-19 pandemic, with a cancellation or postponement rate of up to 87% for benign disease operations.[5] Emergency services were similarly affected, with rates of emergency department visits and emergency operations declining in Spain, Italy, the US, and Portugal.[6-9]

Currently, research into the impact of the COVID-19 pandemic on emergency general surgery (EGS) has shown an overall decline in operation rates but differing experiences in terms of subsequent case severity.[10-13]Prior to COVID-19, acute calculus cholecystitis (AC) was one of the most common reasons for EGS admission, with approximately 700,000 reported cholecystectomies performed annually in the United States.[14, 15] In 2018, gallbladder-related diagnoses comprised 35% of the total EGS volume at our institution.[16] The objective of this investigation was to determine whether the declaration of pandemic was associated with a change in the volume of AC admissions and, further, a change in the severity of disease among patients who did present with AC. We hypothesized that, as a result of the pandemic declaration, we would observe a decrease in AC admissions but an increase in the severity of disease managed.

Materials and methods

Study approval and data sources

Study approval was obtained through the Boston University Medical Campus Institutional Review Board. This study was given exempt status with waiver of informed consent. Cases were identified through an internally maintained registry and data was collected through chart review in compliance with HIPAA guidelines.

Cohort description

A retrospective review was conducted of all adult patients admitted with AC to our institution between January 1 and May 31 in 2018, 2019, and 2020 (N = 157). Patients were included if they were age ≥18 y and presented to our urban safety-net hospital during the study period.

Exposure

The exposure of interest was the time period following the declaration of the COVID-19 pandemic by the WHO (March 11, 2020 - May 31, 2020).

Outcomes

The primary outcome was the difference in mean biweekly admissions for AC prior to and after the declaration of the COVID-19 pandemic as compared to the same time periods in a historical control. Patients with AC admissions were stratified by severity using the 2018 Tokyo Guidelines for grading of acute cholecystitis and sorted into two categories: Tokyo I (mild) and a combined group of Tokyo II (moderate) and III (severe) **(Supplementary Table 1)**.[17] The secondary outcome was the odds of presentation with more severe disease (Tokyo II-III) following the pandemic declaration. Additional outcomes included the differences in mean biweekly admission for AC stratified by disease severity (Tokyo I vs Tokyo II-III) as well as the length of symptoms prior to presentation, and length of stay pre- and postpandemic declaration.

Covariates

Demographic covariates included sex, age, race/ethnicity, language, and presence of insurance.

Statistical analysis

All statistical analysis was performed using SAS® Studio 3.8 software.[18] Significance was set at $\alpha = 0.05$ and all hypothesis tests were two-sided. Descriptive statistics are reported as means with standard deviations for continuous variables and as number and percent for categorical variables. Comparison of demographic variables before and after the pandemic declaration was performed using a *t*-test for continuous variables and Fisher's exact test for categorical variables. Difference-in-differences (DID) analysis of Poisson regressions was performed to compare biweekly AC admissions pre- and postpandemic declaration as well as those stratified by Tokyo classification. The historical control was comprised of an average of biweekly counts from the equivalent time intervals in 2018 and 2019. The parallel trends assumption for DID analysis was tested and no significant difference was found between 2020 and the historical control prior to the pandemic (β −0.19 [SE 0.29], $P = 0.5144$). The odds of presenting with more severe disease following the declaration of pandemic was assessed with multivariable logistic regression modeling and corresponding odds ratios (OR). All patients with missing demographic data were excluded. Variables included in multivariable logistic regression were those with a univariable association ($P < 0.15$) and clinical relevance. To assess differences in mean length of symptoms prior to presentation and length of stay, Poisson regression were performed. For assessment of mean length of symptoms, patients with missing data and outliers (determined by a studentized residual >2) were excluded.

Table 1 – Demographics of population prior to and after the declaration of pandemic. Patients with missing demographic data are excluded (*n* = 137)

	Pre-pandemic declaration (*n* = 124)	Post-pandemic declaration (*n* = 13)	*P*-value
Age (mean, SD)	48.68 (16.77)	45.92 (15.15)	0.5710
Male (*n*,%)	41 (33.06)	2 (15.38)	0.2284
Race (*n*,%)	27 (21.77)	3 (23.08)	0.9510
NH-White	30 (24.19)	4 (30.77)	
NH-Black	4 (3.23)	0 (0.00)	
NH-Other	63 (50.81)	6 (46.15)	
Hispanic			
Insured (*n*,%)	113 (91.13)	13 (100.00)	0.5993

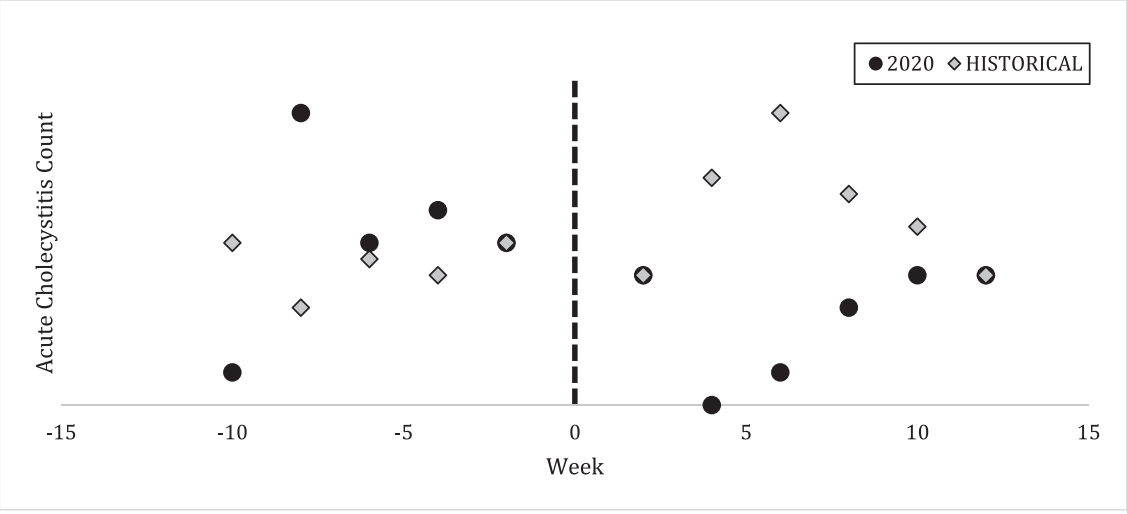

Fig. 1 – Biweekly counts of acute cholecystitis (AC) pre- and post-declaration (2020) compared to historical control. Dashed line corresponds to the declaration of pandemic (N = 157).

Results

Cohort characteristics

The total cohort, consisting of 157 patients, was used for DID analysis. Multivariable regression modeling for odds of presenting with severe disease included 137 patients with complete demographic data. There were no statistically significant differences in age, sex, race, or insurance status prior to and after the pandemic declaration (Table 1). The majority of patients were female, Hispanic, and insured.

AC presentations prior to and after pandemic declaration

There was a significant negative DID of AC admissions pre- and post-declaration periods in 2020 when compared to the historical control (β −1.00 [SE 0.56], $P = 0.02$) (Fig. 1). Mean biweekly AC admissions decreased by 48.7% from 5.20 to 2.67 cases (RR 0.51 [95% CI 0.28,0.96], $P = 0.04$) after the pandemic declaration compared to previous years where it increased from 4.30 to 6.00 cases (RR 1.40 [95% CI 0.82,2.38], $P = 0.22$) (Table 2). When stratified by severity (Figure 2), biweekly Tokyo I admissions decreased significantly after the pandemic declaration (β −1.28 (SE 0.56) $P = 0.02$) from 3.20 to 1.33 cases (58.4%) (RR 0.42 [95% CI 0.18,0.97], $P = 0.04$), compared to a historical increase from 2.50 to 3.75 cases (RR 1.50 [95% CI 0.75,2.99], $P = 0.25$) (Table 2). The DID for Tokyo II-III admissions was not significant (β −0.63 [SE 0.64], $P = 0.33$). Mean biweekly Tokyo II-III admission decreased from 2.00 to 1.33 cases per 2-week interval (RR 0.67 [95% CI 0.26,1.69], $P = 0.39$) after the pandemic compared to an increase from 1.80 to 2.25 cases in the historical control (RR 1.25 [95% CI 0.54,2.91], $P = 0.60$) (Table 2).

Odds of severe disease and additional outcomes after pandemic declaration

Univariable and multivariable logistic regression were used to determine the odds of a severe disease presentation post-declaration compared to all other time frames. In both the unadjusted and the model adjusted for age and race/ethnicity, there were no increased odds of presenting with severe dis-

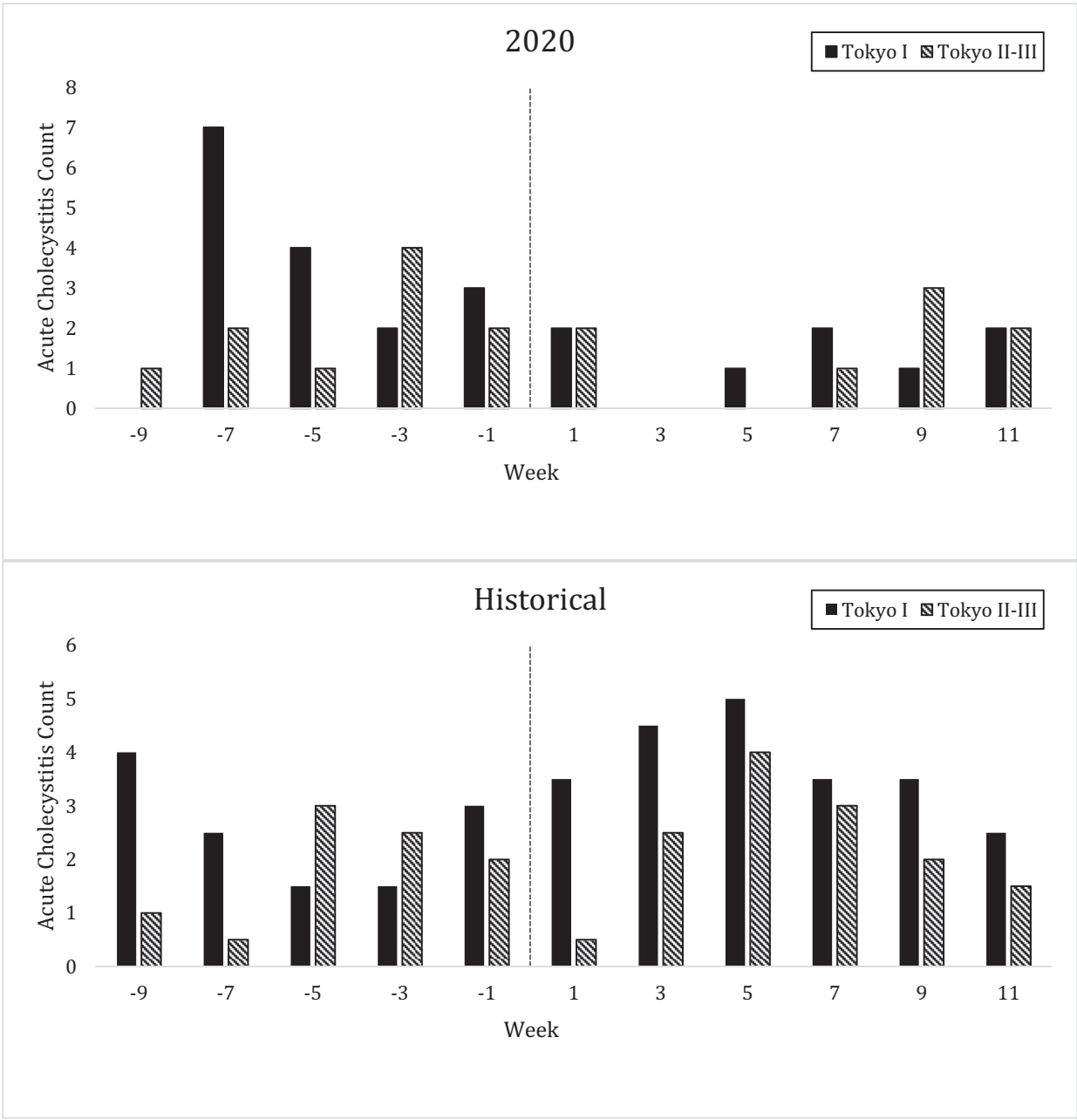

Fig. 2 – Biweekly acute cholecystitis (AC) counts stratified by disease severity (Tokyo classification) in 2020 compared to historical control. Dashed line corresponds to the declaration of pandemic (N = 157).

ease (aOR: 1.00 [95% CI: 0.30, 3.38] $P < 0.99$). When stratified by severity, there was an increased length of symptoms prior to presentation among those with Tokyo I disease after the pandemic declaration: 32.70 vs 24.00 d (RR 1.36 [95% CI 1.20,1.55], $P < 0.0001$) after adjusting for sex and race. For those who presented with Tokyo II-III disease, there was a decreased length of symptoms after the pandemic declaration: 23.47 vs 50.82 d after adjusting for age, sex, and race (RR 0.46 [95% CI 0.39,0.55], $P < 0.0001$). For all AC admissions and when stratified by severity, there was no difference in length of stay before and after the declaration of pandemic.

Discussion

Following the WHO declaration of the COVID-19 pandemic on March 11, 2020, there was a significant decrease in AC admissions at our urban safety-net hospital. Several factors could explain the reduction in cases seen. Most probable is a change in health care seeking behavior due to the pandemic. The National Syndromic Surveillance Program (NSSP) found a 42% decrease in emergency department visits when compared to historical trends, with the largest decreases occurring in the

Northeast and for visits related to abdominal pain.[19] While overall emergency department visits declined, rates of patients presenting with surgical needs and number of surgical procedures performed was especially reduced.[20-24] This pattern was seen globally, with researchers in Spain, Italy, and Portugal reporting decreased rates of emergency department visits and surgical admissions.[6,7,9] Fear of contracting COVID-19 at the hospital and attempting to help ease the burden on the healthcare system were common postulations for reduced visits and admission rates during the pandemic.

While our findings are in line with current research elucidating a change in healthcare-seeking behaviors as a result of the pandemic,[6-9, 20-24] we did not experience the increased severity of disease presentation that we predicted despite increased length of symptoms among those with Tokyo I disease. Tokyo I admissions decreased significantly after the pandemic declaration whereas severe cases (Tokyo II and III) remained stable. Around the world cholecystectomy rates declined and, combined with our data, it could be suggested that the Tokyo I case population were the least at risk for complications due to this phenomenon.[25] It is possible that those with mild (Tokyo I) AC improved at home without medical or surgical intervention instead of progressing to more severe disease. Additionally, patients with AC may have been treated medically by a primary care practitioner in person or through telehealth and, similarly, recovered. Telemedicine has increased dramatically in availability during the COVID-19 pandemic and may have been part of the reason for decreasing rates of AC presentations.[26] We saw no increase in general surgery outpatient referrals for those with Tokyo I AC and experienced an absolute decrease in overall benign gallbladder disease outpatient referrals during this time. During the pandemic surge, however, all new outpatient referrals at our hospital were briefly paused, impacting our ability to study this for statistical significance. Finally, as many restaurants closed, it is possible that modifications in diet contributed to a decreased occurrence of AC. According to the 2020 Food and Health Survey conducted by the International Food Information Council, 60% of Americans during the pandemic reported cooking more often at home, which has been associated with better dietary intake.[27, 28] We did not observe the same decrease in Tokyo II-III admissions suggesting that those with moderate to severe disease continued to seek treatment despite possible hesitations due to COVID-19. Additionally, it appears that those with severe disease presented sooner compared to previous time periods.

The consensus among 7 Italian surgical societies, the World Society of Emergency Surgery, and the American College of Surgeons, however, is that laparoscopic cholecystectomy remains the treatment of choice for acute cholecystitis, even in light of COVID-19.[29, 30] However, given that we did not observe an increase in case severity in this study, our data suggests that a significant portion of mild cases recovered without surgical care. Further study into characteristics that could influence the necessity of surgical intervention in patients presenting with mild cholecystitis is warranted.

Table 2 – Mean biweekly BGD counts stratified by disease severity (Tokyo classification). Presented are means stratified by year with associated rate ratio (RR) for each institution (N = 157).

	Historical				2020			
	Pre-declaration Mean (SD)	Post-declaration Mean (SD)	RR (95% CI)	P-value	Pre-declaration Mean (SD)	Post-declaration Mean (SD)	RR (95% CI)	P-value
Tokyo I (*n* = 96)	2.50 (1.06)	3.75 (0.88)	1.50 (0.75,2.99)	0.25	3.20 (2.59)	1.33 (0.82)	0.42 (0.18,0.97)	0.04
Tokyo II-III (*n* = 61)	1.80 (1.04)	2.25 (1.21)	1.25 (0.54,2.91)	0.60	2.00 (1.22)	1.33 (1.21)	0.67 (0.26,1.69)	0.39
All cases (N = 157)	4.30 (0.84)	6.00 (1.92)	1.40 (0.82,2.38)	0.22	5.20 (2.86)	2.67 (1.75)	0.51 (0.28,0.96)	0.04

Limitations

There are multiple limitations to our study. First, the interpretation of the Tokyo Guidelines can be potentially subjective, with criteria for local inflammation being the most prone to subjectivity. In instances of discordance between pathology and surgical reports, we chose to classify the patient based on the surgical report. Second, we cannot be certain that our results are not due to patients seeking care elsewhere, as we are unable to compare our experience against other hospitals in the region. However, given our status as the only safety-net hospital in Boston and the nature of our patient population, which is in great part under- or uninsured, it is unlikely that our patient population sought care anywhere else. Lastly, and also due to our status as a safety-net hospital, the results from this study may not be generalizable to the U.S. population as a whole.

Conclusion

Our institution experienced a significant decrease in AC admissions following the WHO declaration of the COVID-19 pandemic on March 11, 2020. Our data suggest that the pandemic impacted healthcare-seeking behaviors for patients with milder disease, with fewer presentations for AC, while patients with severe disease continued to present similarly before and after the declaration of the pandemic. Notably, this change in health seeking-behavior was not associated with an increased odds of more severe disease, suggesting that some cases of mild cholecystitis that routinely are treated with surgery may resolve without surgical intervention. Further research is necessary to realize the full impact of the COVID-19 pandemic on incidence, treatment, and long-term outcomes for patients with AC. Furthermore, investigating the progression of disease in patients with acute cholecystitis and possible alternative, nonsurgical, means of treatment is warranted.

Author contributions

KFV, SES, TSB were responsible for study conception and design. EC and KFV were responsible for data collection. MYN was responsible for data analysis. KFV, MYN, SES and TSB were responsible for data interpretation. KFV, MYN, SES, TSB were responsible for manuscript drafting. All authors were responsible for critical review and final approval of the manuscript.

Disclosures

The authors report no proprietary or commercial interest in any product mentioned or concept discussed in this article.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jss.2021.02.037.

REFERENCES

1. CDC COVID Data Tracker. Centers for Disease Control and Prevention. Accessed August 20, 2020, Available at: https://covid.cdc.gov/covid-data-tracker
2. Inside Boston Medical Center: The heart of the coronavirus storm. The Boston Globe. (n.d.). Accessed August 20, 2020, Available at: https://www.bostonglobe.com/2020/04/18/metro/inside-boston-medical-center-heart-coronavirus-storm/
3. Aziz S, Arabi YM, Alhazzani W, et al. Managing ICU surge during the COVID-19 crisis: rapid guidelines. *Intensive Care Med*. 2020;46:1303–1325. doi:10.1007/s00134-020-06092-5.
4. Becker CD, Forman L, Gollapudi L, Nevins B, Scurlock C. Rapid implementation and adaptation of a telehospitalist service to coordinate and optimize care for COVID-19 patients. *Telemed J E-Health*. 2020. doi:10.1089/tmj.2020.0232.
5. Nepogodiev D, Bhangu A. Elective surgery cancellations due to the COVID-19 pandemic: global predictive modelling to inform surgical recovery plans. *BJS (Br J Surg)*. 2020. doi:10.1002/bjs.11746.
6. Cano-Valderrama O, Morales X, Ferrigni CJ, et al. Acute care surgery during the COVID-19 pandemic in Spain: changes in volume, causes and complications. A multicentre retrospective cohort study. *Int J Surg (London, England)*. 2020;80:157–161. doi:10.1016/j.ijsu.2020.07.002.
7. Comelli I, Scioscioli F, Cervellin G. Impact of the COVID-19 epidemic on census, organization and activity of a large urban Emergency Department. *Acta Bio-Med Atenei Parmensis*. 2020;91:45–49. doi:10.23750/abm.v91i2.9565.
8. Westgard BC, Morgan MW, Vazquez-Benitez G, Erickson LO, Zwank MD. An analysis of changes in emergency department visits after a state declaration during the time of COVID-19. *Ann Emerg Med*. 2020;76:595–601. doi:10.1016/j.annemergmed.2020.06.019.
9. Madanelo M, Ferreira C, Nunes-Carneiro D, et al. The impact of the coronavirus disease 2019 pandemic on the utilisation of emergency urological services. *BJU Int*. 2020;126:256–258. doi:10.1111/bju.15109.
10. Manzia TM, Angelico R, Parente A, Muiesan P, Tisone G. Global management of a common, underrated surgical task during the COVID-19 pandemic: Gallstone disease - An international survey. *Ann Med Surg*. 2020;57:95–102. doi:10.1016/j.amsu.2020.07.021.
11. Callan R, Assaf N, Bevan K. Impact of the COVID-19 pandemic on acute general surgical admissions in a district general hospital in the United Kingdom: a retrospective cohort study. *Surg Res Pract*. 2020;2020. doi:10.1155/2020/2975089.
12. McLean RC, Young J, Musbahi A, et al. A single-centre observational cohort study to evaluate volume and severity of emergency general surgery admissions during the COVID-19 pandemic: is there a "lockdown" effect? *Int J Surg*. 2020. doi:10.1016/j.ijsu.2020.09.011.
13. Patel R, Hainsworth AJ, Devlin K, Patel JH, Karim A. Frequency and severity of general surgical emergencies during the COVID-19 pandemic: Single-centre experience from a large

metropolitan teaching hospital. *Ann R Coll Surg Engl*. 2020:1–6. doi:10.1308/rcsann.2020.0147.
14. Gallbladder and Biliary Tract Disease. (n.d.). Accessed August 19, 2020, Available at http://www.clevelandclinicmeded.com/medicalpubs/diseasemanagement/hepatology/gallbladder-biliary-tract-disease/
15. The Growing Global Burden of Gallstone Disease | World Gastroenterology Organisation. (n.d.). Accessed August 19, 2020, Available at https://www.worldgastroenterology.org/publications/e-wgn/e-wgn-expert-point-of-view-articles-collection/the-growing-global-burden-of-gallstone-disease
16. Boston Medical Center Department of Surgery, Section of Acute Care & Trauma Surgery and Surgical Critical Care, 2018 Annual Report. (2016). https://www.bmc.org/acute-care-trauma-surgery
17. Yokoe M, Hata J, Takada T, et al. Tokyo Guidelines 2018: Diagnostic criteria and severity grading of acute cholecystitis (with videos). *J Hepato-Biliary-Pancr Sci*. 2018;25:41–54. doi:10.1002/jhbp.515.
18. The data analysis for this paper was generated using SAS® studio software, 3.8 (Enterprise Edition). Copyright© 2012-2018, SAS Institute Inc., Cary, NC, USA.
19. Hartnett KP, Kite-Powell A, DeVies J, et al. Impact of the COVID-19 pandemic on emergency department visits—United States, January 1, 2019–May 30, 2020. *Morb Mort Wkl Rep*. 2020;69(23):699–704. doi:10.15585/mmwr.mm6923e1.
20. Lima DL, Pereira X, dos Santos DC, Camacho D, Malcher F. Where are the hernias? A paradoxical decrease in emergency hernia surgery during COVID-19 pandemic. *Hernia*. 2020. doi:10.1007/s10029-020-02250-2.
21. Patriti A, Baiocchi GL, Catena F, et al. Emergency general surgery in Italy during the COVID-19 outbreak: first survey from the real life. *World J Emerg Surg*. 2020;15:36. doi:10.1186/s13017-020-00314-3.
22. Patriti A, Eugeni E, Guerra F. What happened to surgical emergencies in the era of COVID-19 outbreak? Considerations of surgeons working in an Italian COVID-19 red zone. *Updates Surg*. 2020;72:309–310. doi:10.1007/s13304-020-00779-6.
23. Nuñez JH, Sallent A, Lakhani K, Guerra-Farfan E, Vidal N, Ekhtiari S, Minguell J. Impact of the COVID-19 pandemic on an emergency traumatology service: experience at a tertiary trauma centre in Spain. *Injury*. 2020;51:1414–1418. doi:10.1016/j.injury.2020.05.016.
24. Pérez-Rubio Á, Sebastián Tomás JC, Navarro-Martínez S, Gonzálvez Guardiola P, Torrecillas Meroño DG, Domingo Del Pozo C. Incidence of surgical abdominal emergencies during SARS-CoV-2 pandemic. *Cirugia Espanola*. 2020. doi:10.1016/j.ciresp.2020.06.017.
25. Manzia TM, Angelico R, Parente A, Muiesan P, Tisone G. Global management of a common, underrated surgical task during the COVID-19 pandemic: gallstone disease - An international survey. *Ann Med Surg*. 2020;57:95–102. doi:10.1016/j.amsu.2020.07.021.
26. Bashshur R, Doarn CR, Frenk JM, Kvedar JC, Woolliscroft JO. Telemedicine and the COVID-19 Pandemic, Lessons for the Future. *Telemed E-Health*. 2020;26:571–573. doi:10.1089/tmj.2020.29040.rb.
27. 2020-Food-and-Health-Survey-.pdf. (n.d.). Accessed August 16, 2020, Available at https://foodinsight.org/wp-content/uploads/2020/06/2020-Food-and-Health-Survey-.pdf
28. Wolfson JA, Bleich SN. Is cooking at home associated with better diet quality or weight-loss intention? *Public Health Nutr*. 2015;18:1397–1406. doi:10.1017/S1368980014001943.
29. Campanile FC, Podda M, Arezzo A, et al. Acute cholecystitis during COVID-19 pandemic: a multisocietary position statement. *World J Emerg Surg : WJES*. 2020;15. doi:10.1186/s13017-020-00317-0.
30. March 25, U., & 2020. (n.d.). COVID-19 Guidelines for triage of emergency general surgery patients. American College of Surgeons. Accessed August 19, 2020, Available at https://www.facs.org/covid-19/clinical-guidance/elective-case/emergency-surgery