Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Implementation and Impact of Universal Preprocedure Testing of Patients for COVID-19 Before Endoscopy

Alexander Podboy,[1,*] **George Cholankeril**,[1,*] Lisa Cianfichi,[2] Edward Guzman Jr,[2] Aijaz Ahmed,[1] and Subhas Banerjee[1]

[1]*Division of Gastroenterology and Hepatology, Department of Internal Medicine, Stanford University School of Medicine, Stanford, California; and* [2]*Stanford Hospital and Clinics, Stanford, California*

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The Centers for Disease Control and Prevention reported 64,479 cases of coronavirus disease 2019 (COVID-19) infection and 309 deaths among United States (US) health care workers as of May 30, 2020.[1] Endoscopy room staff may be at increased risk for acquiring infection, because COVID-19 is detectable in the gastrointestinal tract[2] and endoscopy is an aerosol-generating procedure. US gastroenterology societies issued guidance to delay elective procedures for reasons including minimizing risk of transmission of infection within hospitals and to vital health care workers.[3] Concern regarding acquiring COVID-19 infection in the workplace and transmitting this to family is a source of significant stress for endoscopy unit personnel across the US.[4]

Recognizing these issues, our institution initiated a program for preprocedure COVID-19 testing for all patients undergoing endoscopy starting April 1, 2020. Preprocedure testing was subsequently supported by joint American Gastroenterology Association/Digestive Health Physicians Association guidance on April 27, 2020.[5] We assessed the outcomes and impact of our first 8 weeks of preprocedural screening and testing for COVID-19.

Methods

We performed a retrospective review of patients undergoing preprocedural COVID-19 screening and testing (April 1 to May 31, 2020) after approval by our Institutional Review Board. Our algorithm for screening and testing is depicted in Figure 1. A survey assessing the impact of pre-endoscopy COVID-19 testing was performed (Methodology detailed in the Appendix).

Results

No outpatients had concerning symptoms on screening by our anesthesia preoperative evaluation clinic. During the study period, 1041 patients were evaluated, with 999 COVID-19 tests administered to 907 unique patients (69.5% outpatients). Only 2 tests returned positive: the first was an asymptomatic outpatient, and the second was a patient presenting to the emergency department with sigmoid volvulus. The total positive rate was 2 of 999 (0.20%), with an outpatient rate of 1 of 694 (0.14%) and inpatient rate of 1 of 294 (0.34%), compared with a 4.34% positivity rate from larger population testing in Santa Clara County. No known COVID-19 infections have occurred in endoscopy unit personnel or patients since the commencement of preprocedure testing.

We also evaluated records of patients undergoing endoscopy before initiation of preprocedural testing. Of 741 patients undergoing endoscopy in March, 214 (28.9%) underwent subsequent COVID-19 testing, 43 within 14 days of the procedure. Only 1 of 214 patients developed a positive test, at 29 days postprocedure.

The online survey was completed by 47 endoscopy unit personnel (27 physicians). (Supplementary Table 1).

Concern Regarding Acquiring COVID-19 Infection and Mental Stressors

After implementation of testing, mean concern score (0-10 scale) among endoscopy unit personnel regarding acquiring COVID-19 infection decreased from 7.5 (95% confidence interval, 6.8-8.3) to 3.8 (95% confidence interval, 3.2-4.5; $P < .001$). Fewer respondents reported anxiety regarding contracting infection (58.1% pre vs 44.7% post, $P < .001$), and a decrease in anxiety regarding infecting family members was evident (88.4% pre vs 68.4% post, $P < .05$). Fewer respondents reported self-isolation practices, with fewer providers living in a separate room from the family (21.3% pre vs 10.8% post, $P < .05$).

Impact on Personal Protective Equipment Use

Among those who responded, 34% indicated being comfortable using surgical masks rather than N-95 respirators in patients testing negative, and 61.7% indicated preference for a powered air-purifying respirator over an N-95 respirator for patients testing positive. Of respondents, 85% indicated being more comfortable with extended all-day use of a single N-95 respirator, and 44.7% were more

*Authors share co-first authorship.

Abbreviations used in this paper: **APEC, anesthesia preoperative evaluation clinic; COVID-19, coronavirus disease 2019; F/U, follow-up; PCP, primary care physician; PPE, personal protective equipment; US, United States.**

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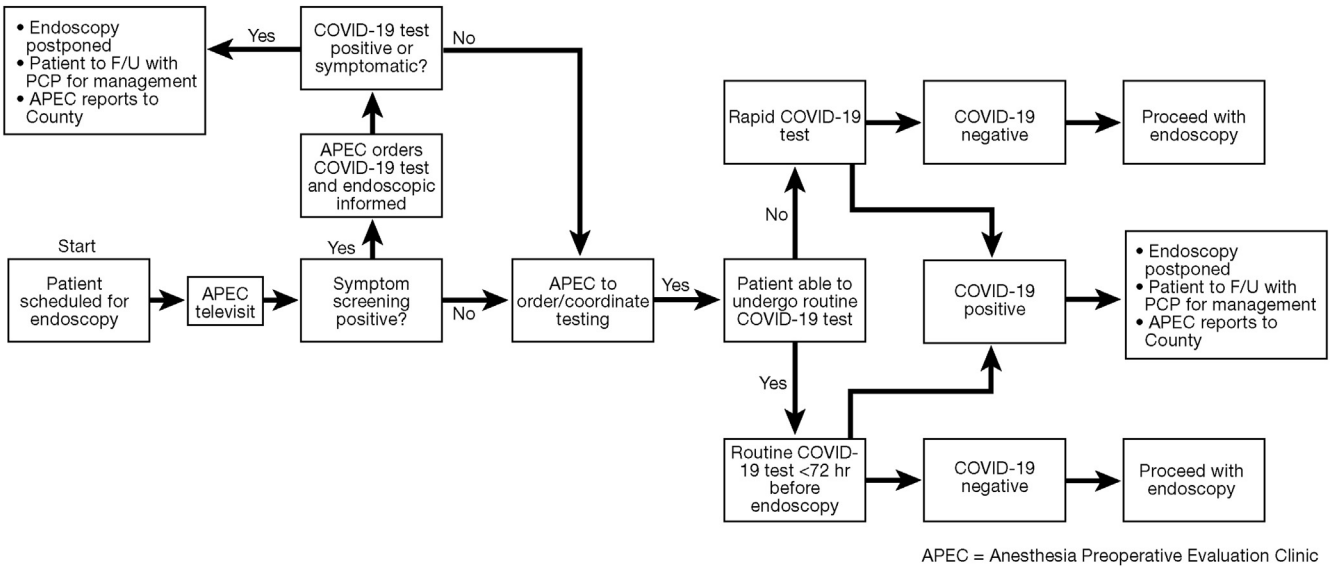

Figure 1. Algorithm for preprocedural screening and testing of endoscopy patients for COVID-19. APEC, anesthesia preoperative evaluation clinic; F/U, follow-up; PCP, primary care physician.

comfortable using a reprocessed N-95 respirator in patients testing negative. Greater carelessness with donning and doffing personal protective equipment (PPE) was reported by 31.9% of respondents in patients testing negative.

Additional Positive Impacts of Testing

Testing impacted education of trainees, with 38 of 40 of nontrainee respondents (95%) indicating they would be more likely to allow trainee participation in patients testing negative. Perceived decreases in patient anxiety, efficiency of patient throughput, procedure room turn-around time, and preferential use of monitored anesthesia care over general anesthesia were appreciated with initiation of preprocedural testing (Supplementary Figure 1).

Discussion

Concern regarding spread of COVID-19 by asymptomatic patients[6] prompted many centers to undertake preprocedural and pre surgical testing for the virus. However, this approach remains varied across US endoscopy centers, with our recent survey indicating that only 52% of responding centers performed testing on all patients before endoscopy.[4]

Our institutional data from a low-prevalence region suggests that positivity for COVID-19 in asymptomatic patients undergoing endoscopy is a rare event, detected in only 2 of 999 tests. Thus, in low-prevalence regions, preprocedure symptom screening of patients may arguably be an adequate measure for minimizing risk of infection transmission. Our triple-screening process (gastroenterology clinic, scheduling office, and anesthesia preoperative evaluation clinic) appears to be very effective. Pursuit of testing may therefore potentially be dictated by local prevalence rates, but the additional less tangible benefits of testing merit contemplation.

Our survey indicates significant improvement in the mental well-being of both patients and endoscopy unit staff, who no longer feel they are in a high-risk environment. Reports from China indicate a high prevalence of mental health symptoms in frontline health care workers,[7] findings confirmed in our survey of US endoscopy centers.[4] The mental well-being of health care workers has been largely neglected during this pandemic, despite concerns raised by many.[4,8] Preprocedural testing has done much to decrease the palpable anxiety previously evident in our endoscopy unit and has been a major step in improving the mental well-being of our faculty, staff, and patients.

An additional benefit of testing is in potentially decreasing use of elements of PPE that may be in short supply. Test negativity was associated with one-third of respondents indicating comfort with wearing a surgical mask rather than an N-95 respirator, approximately one-half indicating more comfort using reprocessed N-95 respirators, and most indicating more comfort with all-day extended use of a single N-95 respirator. An unexpected effect of testing was a decline in carefulness in donning and doffing PPE in one-third of respondents.

The education of trainees was significantly impacted by the pandemic, with more than half of surveyed institutions excluding them from endoscopic procedures[4] to minimize PPE use and to increase the speed and safety of procedures. A final important benefit of preprocedural testing is the increased likelihood of trainees being allowed to participate in procedures.

Conclusion

Our study indicates that preprocedural testing of endoscopy patients for COVID-19 in low-prevalence areas has a low yield, but offers many additional significant

benefits, which should be considered by centers contemplating adopting this process.

Supplementary Material

Note: To access the supplementary material accompanying this article, visit the online version of *Gastroenterology* at www.gastrojournal.org, and at https://doi.org/10.1053/j.gastro.2020.06.022

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Correspondence
Address correspondence to: Subhas Banerjee, MD, Division of Gastroenterology and Hepatology, Stanford University School of Medicine, 300 Pasteur Dr, MC 5244, Stanford, CA 94305. e-mail: subhas.banerjee@stanford.edu.

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CRediT Authorship Contributions
Alexander Podboy, MD (Data curation: Equal; Formal analysis: Lead; Methodology: Equal; Validation: Equal; Writing – original draft: Equal; Writing – review & editing: Equal). George Cholankeril, MD (Data curation: Equal; Formal analysis: Lead; Methodology: Equal; Validation: Equal; Writing – original draft: Supporting; Writing – review & editing: Equal). Lisa Cianfichi, MSN (Data curation: Equal; Methodology: Supporting; Project administration: Lead; Software: Equal; Validation: Supporting; Writing – review & editing: Supporting). Edward Guzman Jr, BS (Data curation: Equal; Formal analysis: Equal; Methodology: Equal; Software: Equal; Validation: Equal; Writing – review & editing: Supporting). Aijaz Ahmed, MD (Data curation: Supporting; Formal analysis: Supporting; Methodology: Equal; Project administration: Equal; Supervision: Equal; Writing – original draft: Equal; Writing – review & editing: Equal). Subhas Banerjee, MD (Conceptualization: Lead; Data curation: Equal; Formal analysis: Equal; Investigation: Lead; Methodology: Lead; Project administration: Equal; Software: Equal; Supervision: Equal; Validation: Equal; Writing – original draft: Equal; Writing – review & editing: Equal).

Conflicts of interest
The authors disclose no conflicts.

Appendix

Methods

Symptom Screening

All new patients for whom endoscopic procedures were ordered at our 2 main endoscopy units were prescreened by our endoscopy schedulers for symptoms concerning for coronavirus disease 2019 (COVID-19) infection at the time of procedure scheduling. Because direct access endoscopy was minimized during this pandemic, many were also previously screened for symptoms during televisits with our gastroenterologists. Once the endoscopic procedure was scheduled, an anesthesia preoperative evaluation (APEC) clinic televisit was scheduled for additional COVID-19 symptom screening. Thus, many patients underwent "triple symptom screening," at the gastroenterology clinic televisit, by the scheduling office and subsequently by APEC.

The APEC screening questionnaire elements are listed below:

1. Presence of new flu-like symptoms, cough, sore throat, fever, shortness of breath, anosmia, dysgeusia, or gastrointestinal symptoms such as nausea, vomiting, diarrhea, abdominal pain or weight loss in the last 2 weeks
2. Direct contact with a COVID-19–positive patient

Preprocedure COVID-19 Testing

Patients with positive symptom screens were referred for COVID-19 testing, triaged for procedural urgency, and the procedure delayed if nonurgent. All patients with a negative symptom screen were directed to undergo routine nasopharyngeal COVID-19 testing, ideally within 72 hours of their scheduled procedure. Patients who were unable to obtain routine COVID-19 testing (due to physical, economic, or geographic limitations), obtained point-of-care rapid COVID-19 testing on the day of their procedure (Supplementary Figure 1). Routine testing was preferred over rapid testing due to a limited supply of rapid tests and the potential for procedural delays related to pending same-day test results.

Routine and rapid testing both involved collection of nasopharyngeal samples as detailed below:

1. Tilt patient's head back 50° to 70°.
2. Insert swab into nostril parallel to the palate, gently rotating the swab inward until resistance is meet. (Swab should reach depth equal to the distance from the nostrils to the outer opening of the ear.)
3. Rotate swab in place for several seconds to absorb secretions (approximately 10 seconds).
4. Slowly remove swab while rotating it.
5. Place tip of swab immediately into sterile viral transport media tube and snap/cut off the applicator stick.

Routine COVID-19 Testing

Routine testing for COVID-19 at our institution uses the Stanford Health Care Clinical Virology Laboratory real-time reverse-transcriptase polymerase chain reaction laboratory-developed test (SHC-LDT) targeting the E gene. Clinical sensitivity of the SHC-LDT is estimated to be 96%, and clinical specificity approaching 100%.

Rapid COVID-19 Testing

Rapid testing uses the Xpert Xpress TM-I SARS-CoV-2 assay (Cepheid, Sunnyvale, CA). This assay has an over 99% agreement compared with high-complexity assays such as the SHC-LDT assay. This is contrasted to higher rates of false-negative testing identified in the Abbott ID NOW (Abbott, Abbott Park, IL) and the Accula SARS-COV-2 (Mesa Biotech, San Diego, CA) rapid testing.

Patient Refusal or Inability to Be Tested

Providers of patients who refused COVID-19 testing were alerted to call the patient to explore reasons for patients' refusal and to discuss the rationale of testing. Our current institutional policy is that patients have the right to make an informed refusal. In patients persisting with an informed refusal to get tested, if endoscopy was urgently needed and would be performed if the patient was known to be COVID-19 positive, our policy is to proceed to endoscopy with all staff wearing full PPE. Similarly, for patients who could not be tested due to inability to cooperate because of cognitive impairment, our policy is to proceed to endoscopy with all staff wearing full PPE.

All endoscopic procedures in patients testing negative for COVID-19 status were performed with N-95 respirators in addition to full PPE. Procedures in patients testing positive for COVID-19 were performed using powered air purifying respirators (PAPR) in addition to full PPE. Decisions regarding the type of respirator to use during endoscopy for patients who did not get tested or refused COVID-19 testing was at the discretion of the endoscopist.

Assessment of Patients Undergoing Endoscopy Before Initiation of Universal Preprocedure Testing

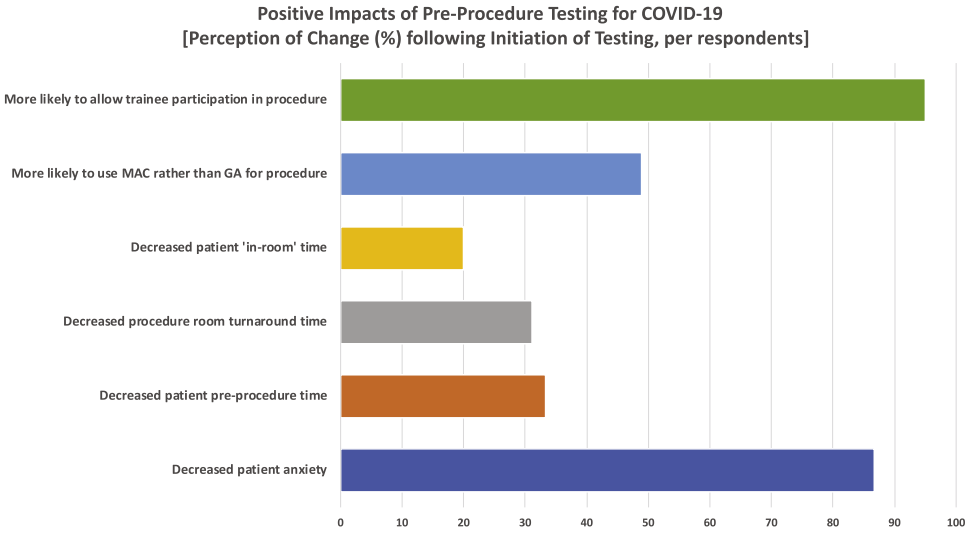
Our institution began testing for COVID-19 on March 4, 2020. However, testing performed in the month of March was limited to symptomatic patients only. Therefore, to attempt to assess infection transmission rates at our endoscopy unit before implementation of universal testing on April 1, 2020, we evaluated records of all patients undergoing endoscopy in March to determine whether any patients were subsequently tested for COVID-19 and whether they tested positive. Our assumption was that positive testing for COVID-19 within 2 weeks of endoscopy might imply the possibility of a causal relationship with the procedure, whereas community acquisition of infection would be more likely in patients testing positive beyond 2 weeks of their procedure.

Survey Instrument and Distribution

An online survey was developed by an advanced endoscopist (S.B.) to evaluate the impact of preprocedure testing for COVID-19 on endoscopy unit personnel. The survey comprised 15 questions and was designed to be completed within 3 to 4 minutes. The survey was reviewed by 3 additional endoscopists (G.C., A.P., A.A.) and modified for clarity and appropriateness. A direct link to the online survey instrument (Survey Monkey, Palo Alto, C) was distributed via e-mail to active endoscopists and staff during the study period. Responses were collected anonymously over a 4-day period, after which the survey was closed (Supplementary Table 1).

Statistical Analysis

Statistical analyses were conducted using Stata 15.1 statistical software (StataCorp, College Station, TX).



Supplementary Figure 1. Positive impacts of pre-procedure testing for COVID-19.

Supplementary Table 1. Summary of Survey Responses on Preprocedure Testing for COVID-19

Survey responses n (%)		
Responder role	47 (100)	
Endoscopy nurse/technician	20 (42.6)	
Fellow	6 (12.8)	
Physician endoscopist	21 (44.7)	
Level of concern regarding contracting COVID-19 infection at work		
Level of concern	Prior to initiating testing	After initiating testing [a]
1 (not concerned)	2 (4.3)	4 (8.5)
2	1 (2.1)	13 (27.7)
3	2 (4.3)	7 (14.9)
4 (mildly concerned)	2 (4.3)	9 (19.2)
5	1 (2.1)	7 (14.9)
6	2 (4.3)	0 (0.0)
7 (moderately concerned)	12 (25.5)	3 (6.4)
8	5 (10.6)	0 (0.0)
9	6 (12.8)	4 (8.5)
10 (highly concerned)	14 (29.8)	0 (0.0)
Concern regarding false negative results of COVID-19 tests		
1 (not concerned)	5 (10.6)	
2	10 (21.3)	
3	6 (12.8)	
4 (mildly concerned)	11 (23.4)	
5	6 (12.8)	
6	0 (0.0)	
7 (moderately concerned)	3 (6.4)	
8	2 (4.3)	
9	2 (4.3)	
10 (highly concerned)	2 (4.3)	
If COVID-19 testing is negative, is the respondent comfortable wearing a surgical mask during the procedure?		
Comfortable wearing a surgical mask	18 (34)	
Prefer to Continue using N-95 respirator	31 (66)	
If COVID-19 testing is positive, is the respondent comfortable wearing a N-95 respirator during the procedure?		
Comfortable wearing a surgical mask	18 (38.3)	
Prefer to wear a powered air purifying respirator (PAPR)	29 (61.7)	
Has the level of care you undertake donning and doffing PPE changed as a consequence of preprocedural COVID testing of patients? (Assuming a negative test result)		
More careless	15 (31.9)	
Same amount of care as before testing was initiated	32 (68.1)	

Supplementary Table 1. Continued

Survey responses n (%)		
Are you more comfortable with having to use a single N-95 respirator all day (due to supply shortages), since pre-procedure testing was initiated?(assuming all your patients have tested negative for COVID-19)		
No	7 (14.9)	
Yes	40 (85.1)	
Are you more comfortable with having to use a reprocessed N-95 respirator (due to supply shortages), since pre-procedure testing was initiated? (assuming all your patients have tested negative for COVID-19)		
No	26 (55.3)	
Yes	21 (44.7)	
Are you more likely to allow GI fellows/nurse trainees/technician trainees participate in endoscopic procedures on patients whose pre-procedure test is negative for COVID-19?		
Yes	38 (80.9)	
No	2 (4.3)	
NA (trainee respondent)	7 (14.9)	
Do you believe any of these potential positive impacts have occurred as a consequence of pre-procedure testing for COVID-19		
Decreased patient anxiety levels about being in the endoscopic unit	39 (86.7)	
Decreased patient time in preprocedure areas	15 (33.3)	
Decreased procedure room turnaround time	14 (31.1)	
Decreased patient "in-room" time	9 (20.0)	
Greater likelihood of utilizing MAC rather than GA for the procedure	22 (48.9)	
Have you experienced any of the following symptoms as a consequence of working during this pandemic?		
Symptom	Prior to initiating testing	After initiating testing
Anxiety for yourself	25 (58.1)	17 (44.7)[a]
Anxiety about Infecting your family	38 (88.4)	26 (68.4)[a]
Feeling stressed	28 (65.1)	22 (57.9)
Insomnia/difficulty sleeping	11 (25.6)	4 (10.5)
Loss of appetite	1 (2.3)	1 (2.6)
What lifestyle modifications have you undertaken in response to the COVID-19 pandemic?		
Lifestyle modification	Prior to initiating testing	After initiating testing
Living away from family home	2 (4.3)	1 (2.1)
Living or sleeping in a separate room, isolated from rest of family	10 (21.3)	6 (12.8)[a]
Changing out of work clothing, before or immediately on reaching home	41 (87.2)	37 (78.7)
Showering immediately on reaching home	36 (76.6)	31 (66.0)
Leaving work shoes in the car or garage	36 (76.6)	34 (72.3)
Wiping down car door handles and steering wheel	23 (48.9)	18 (38.3)
None of the above	4 (8.5)	5 (10.6)

NOTE: Data are presented as number (%).
[a]*P* value $< .05$.