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Review

The new normal: a review of the impact of COVID-19 on gastroenterology fellowship training

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***Abstract*:** The COVID-19 pandemic had a significant impact on medical education and gastroenterology fellowship training. As a result of the pandemic, a trainee's physical safety, mental health and wellness, clinical and procedural training, and educational opportunities were all potentially altered. Changes necessitated at the start of the pandemic were different than those needed further along in the pandemic course. Fellowship programs were required to modify policies and adapt to changes rapidly to advocate for their trainees and ensure quality education. Much of COVID-19's initial impact on education – decreased endoscopic procedures and the loss of educational conferences – has largely returned to pre-pandemic form. However, other changes made during the pandemic have persisted and likely will continue in the future. This includes a virtual interview format for fellowship matches, a virtual option for many national conferences, and an expansion of simulation training. This article reviews the impact that COVID-19 had on medical education with a specific focus on gastroenterology fellowship. The paper highlights the initial impact of COVID-19, the lingering effects, and discusses the areas needed for further research to best understand the total impact COVID-19 had on our trainees' education.

Keywords: COVID-19, gastroenterology, medical education, mental health, procedural training, trainee, well-being

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Introduction

Since the start of the COVID-19 pandemic, approximately 750 million COVID-19 cases and more than 6 million COVID-related deaths have been reported worldwide.[1,2] The COVID-19 pandemic has dramatically impacted the medical education of many trainees as typical day-to-day routines were disrupted. For trainees, the volume and diversity of patient encounters and medical procedures decreased and the way they communicated with both patients and colleagues fundamentally changed. Even more pressing, healthcare providers and trainees struggled to balance their professional and personal lives, with many dealing with feelings of burnout, depression, and anxiety arising throughout the pandemic.

The effect of COVID-19 on medical education varied at different stages throughout the pandemic. When the pandemic first began, hospital resources were almost unilaterally dedicated to fighting the pandemic; routine procedures were canceled, student rotations and classes were canceled, and at first trainees and students were told to stay home. As resources became scarce, medical providers, including trainees and students, were redeployed and often mandated into new roles taking care of an incredibly sick population from a virus we did not yet understand. As the number of cases decreased and vaccines were developed, the medical community gradually developed a better understanding of COVID-19. In time, these changes led to a partial return to pre-pandemic normalcy for many aspects of

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medical education. In addition to the obvious impact of COVID-19 on one's physical health, this article adapted Zunin and Meyers' theoretical model on emotional responses to the phases of a disaster to describe the impact of a pandemic on the mental health of the educational community.

Throughout the pandemic, medical educators at both the undergraduate and graduate levels adapted rapidly, to maximize learning for their learners. Training programs saw the expansion of virtual conferences and grand rounds, increased use of simulation, and dramatic changes to the entire interview process for the recruitment of future students and trainees. Some of these initial changes to medical education have phased out as gastroenterology fellowships have resumed typical day-to-day operations. Yet, some of the innovations and changes that stemmed from the pandemic will likely remain for years to come. This article aims to highlight the key impacts the COVID-19 pandemic had on the medical education community with a particular focus on gastroenterology fellows and their training.

Physical health

As the COVID-19 pandemic unfolded, frontline healthcare workers had an increased risk of contracting COVID-19.[3,4] At the peak of the first wave, from February to April 2020, the Centers for Disease Control and Prevention conducted a study revealing that approximately 20% of COVID-19 cases identified in the United States were among healthcare workers. Approximately 50% of these individuals contracted COVID-19 in the healthcare setting. While 90% of the infected healthcare workers did not require hospitalization, a higher number of deaths occurred in individuals aged 65 years and older.[5]

To assess the health impact of the pandemic on trainees, the Accreditation Council for Graduate Medical Education (ACGME) formulated a supplementary survey to its annual program data update, collected from all programs and sponsoring institutions.[6] The goal of the survey was to capture the health impacts of the pandemic on residents and faculty during the spring and early summer of 2020 across the country, not just in pandemic 'hot spots'. During the first 4 months of the pandemic, approximately 40% of all resident and fellowship programs reported at least one trainee being quarantined due to COVID-19. The ACGME survey further reported that 139 programs hospitalized one or more residents. Unfortunately, there were four trainee deaths between March and June 2020 due to COVID-19.[6] The effects of long-COVID-19 on trainees have not yet been reported.

COVID-19 disproportionately impacted specific communities. Healthcare workers who were 65 years and older endured more burden of the disease than other age groups.[7] Comparably, hospitalizations of faculty members were reported more frequently than for residents, with approximately 46 programs reporting the death of a faculty member across 26 different specialties during the initial phase of the pandemic.[8] The United Kingdom was the first to publish findings showing that two-thirds of the healthcare workers who died from COVID were from Black, Asian, and Minority Ethnic communities, a trend that was seen in the general population throughout the pandemic.[9] The data collected do not include the corresponding effects of the impact of COVID-19 on the physical health of the family members and loved one's medical providers lived with or had close contact with during the pandemic.

Mental health

Perhaps the most significant impact of COVID-19 on healthcare workers is the impact on their mental health. A theoretical model, developed by Zunin and Meyers, provides a framework for the individual and collective emotional responses to phases of disaster. The U.S. Department of Health and Human Services cites this model in DeWolfe's *Training Manual for Mental Health and Human Service Workers in Major Disasters* to delineate the impact of medical disasters on those working through them.[10] This model has been applied to various medical disasters and the response to COVID-19 has unfolded in ways the model would have predicted.[11]

Zunin and Meyers suggest that an initial 'impact' phase of a disaster (observed at its onset) is followed by a 'heroic' phase characterized by a surge in adrenaline-induced rescue behavior resulting in volunteerism and altruism. This leads to a period of community bonding and universal support for those working in a medical disaster, also termed the 'honeymoon' or 'Remedy' phase. As the larger community returns to business as usual and there is some decrease in adrenaline that

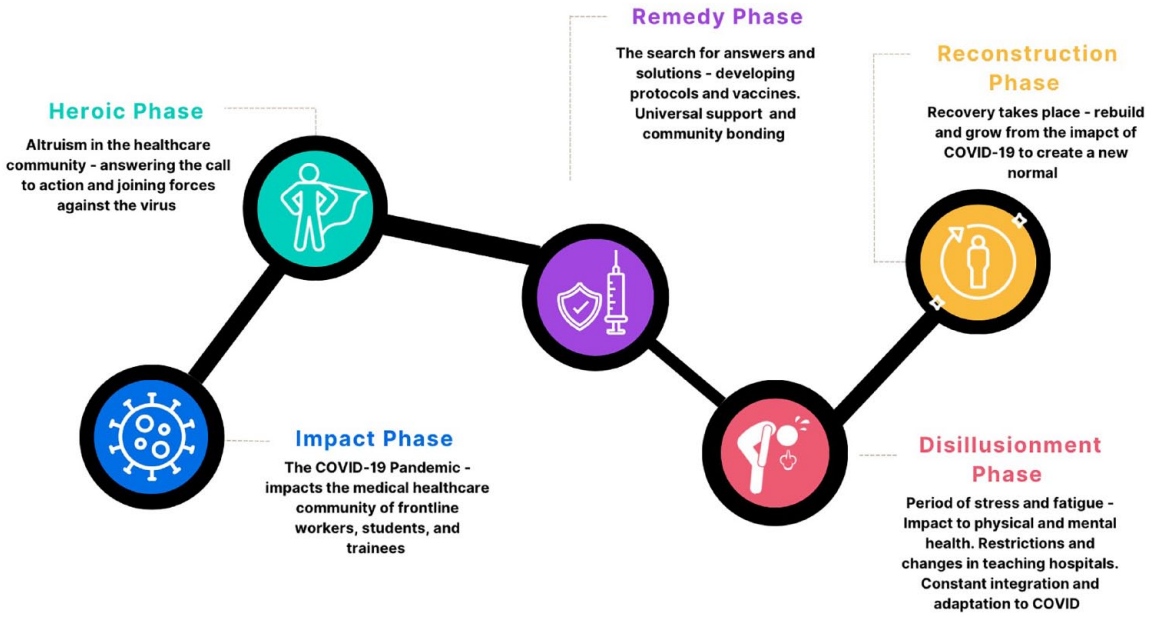

Figure 1. Zunin and Meyers' theoretical framework for emotional response as applied to the COVID-19 pandemic.

captured the initial surge, survivors begin to enter a 'disillusionment' phase characterized by high stress, physical exhaustion, an increase in substance abuse, and questionable altruism. The final phase, 'reconstruction' and emotional recovery may continue for years as survivors of a disaster readjust and integrate into new surroundings. The relevance of these phases in medical communities can be seen in the fallout of the pandemic. Figure 1 demonstrates how each phase of the model corresponds to the impact of the COVID-19 pandemic on the medical education community. This article will utilize Zunin and Meyers' framework in discussing the impact of COVID-19 on the wellness and mental health of trainees at different stages during the pandemic.

Heroic and remedy phases

The pandemic initially created a sense of comradery among medical providers and led to numerous individuals offering services outside their specialties, serving as hospitalists, or working alongside infectious disease and pulmonary specialists caring for the sickest of COVID patients.[12] Residents and fellows, vital members of any teaching hospital, were also redeployed to different services across their institutions, particularly in regions hit with large caseloads, such as New York City.[8] Retired doctors also responded to a call for action by rejoining the workforce through waved or expedited licensure for inactive or retired medical licensees.[13] Frontline workers were seen as 'healthcare heroes'. The upsurge in volunteerism was recognized in the general population with 7:00 p.m. clapping becoming a common occurrence and local communities and national brands offering medical professionals food delivery services, discounts on scrubs and shoes, and access to meditation resources.[12,14]

During the COVID-19 pandemic, medical students also played a unique role in the healthcare community. Initially, a press release from the Association of American Medical College (AAMC) issued guidelines for medical students – strongly encouraging a pause in all participation of direct patient care.[15] However, medical schools soon allowed fourth-year students to graduate early to expedite the commencement of residency training and help offset the increased demand for healthcare workers in caring for COVID patients.[16] At first, there appeared to be a benefit for the volunteers with studies of medical students in both New York and the United Kingdom demonstrating benefits in clinical learning and satisfaction,[17–19] while a study of new medical school graduates in Spain demonstrated satisfaction and willingness to volunteer.[20]

While some physicians were at the frontlines caring for patients, others were guiding the development of new drugs and vaccines. The global vaccine research and development effort in response to the COVID-19 pandemic was unprecedented in terms of technology, scale, funding, and speed.[21] In fact, physicians and young medical trainees volunteered their enrollment as some of the first participants in new vaccine trials, leading the way by example.[22]

While much of this positive appreciation toward healthcare workers continued throughout the heroic and honeymoon phase, negative aspects of managing the COVID-19 pandemic eventually led to burnout and disillusionment.

Disillusionment phase

As mentioned earlier, during the COVID-19 pandemic, the phrase 'healthcare heroes' was used frequently. However, this phrase may have placed unrealistic expectations upon healthcare workers.[14] When stress takes a toll on survivors' physical and mental health over an extended period, the 'disillusionment' phase in Zunin and Meyers' model becomes predominant. While there was certainly anxiety and fear at the start of the pandemic, burnout among healthcare workers continued to grow and worsen after the initial first wave of COVID-19 cases.

It is important to remember that prior to COVID-19, mental health was already an active concern for the medical community. In practicing physicians, suicide has remained one of the top causes of early death.[23] The prevalence of anxiety (30%) and depression (23%) has been well documented among medical students.[24,25] Substance abuse in medical students is relatively common, with upward of 33% of medical students meeting diagnostic criteria for alcohol use/dependence, especially among students who were burned out, depressed, or reported low mental or emotional quality of life.[26] Medical students and residents experience depression at higher rates than the young adult general population.[27] An ACGME study reported suicide as the second leading cause of death for trainees from 2000 to 2014.[28] The exact rate of suicide among medical students is unclear, although some reports put it as higher than for the trainee population.[29,30]

With COVID-19, challenges with mental health worsened for healthcare workers, particularly during the disillusionment phase as described by Zunin and Meyers. A cross-sectional survey study of over 20,000 physicians demonstrated that the rates of burnout increased parabolically throughout 2021, with an especially sharp rise at the end of the year, almost 18 months after the pandemic started.[31]

In a Physician's Foundation report, approximately 2300 physicians responded to a survey regarding the impact of COVID-19 on physician well-being. Approximately 50% of physicians experienced inappropriate anger or tearfulness due to COVID-19, with 58% of physicians reporting feelings of burnout.[32] Additional studies during the pandemic reported an 8% rate of thoughts of self-harm, while only 13% of physician respondents sought out medical attention for mental health during the pandemic.[33] Rates of burnout and reported intentions to leave medicine were associated with chaotic workplaces, low work control, poor teamwork, and feelings of being undervalued.[34] One literature review explored traumatic stress in healthcare workers in 2020 and found the prevalence of trauma-related stress to be between 3.4% and 35%, with higher rates concentrated among women, nurses, and frontline workers.[35]

Mental health worsened during the COVID-19 pandemic for medical students as well. Rates of general anxiety disorder and major depressive disorder in the era of COVID-19 reportedly increased by 61% and 70%, respectively, when compared to previous studies.[25] Approximately 11% of students who served in New York hospitals as early graduates and who reported initial satisfaction later reported feelings of burnout.[17] Medical students around the world also experienced similar changes in mental health. In a study conducted by Tashiro *et al.*, Japanese medical students were found to be less physically active, having longer sedentary time and longer leisure screen time during the pandemic, all of which were associated with depression.[36] In a survey conducted among Australian medical students, two-thirds reported a deterioration in mental well-being since the onset of the pandemic, with a lack of social connectedness serving as a major contributing factor.[37] Two years after volunteering to treat COVID-19 patients, medical students in Spain reported feelings of stigmatization and

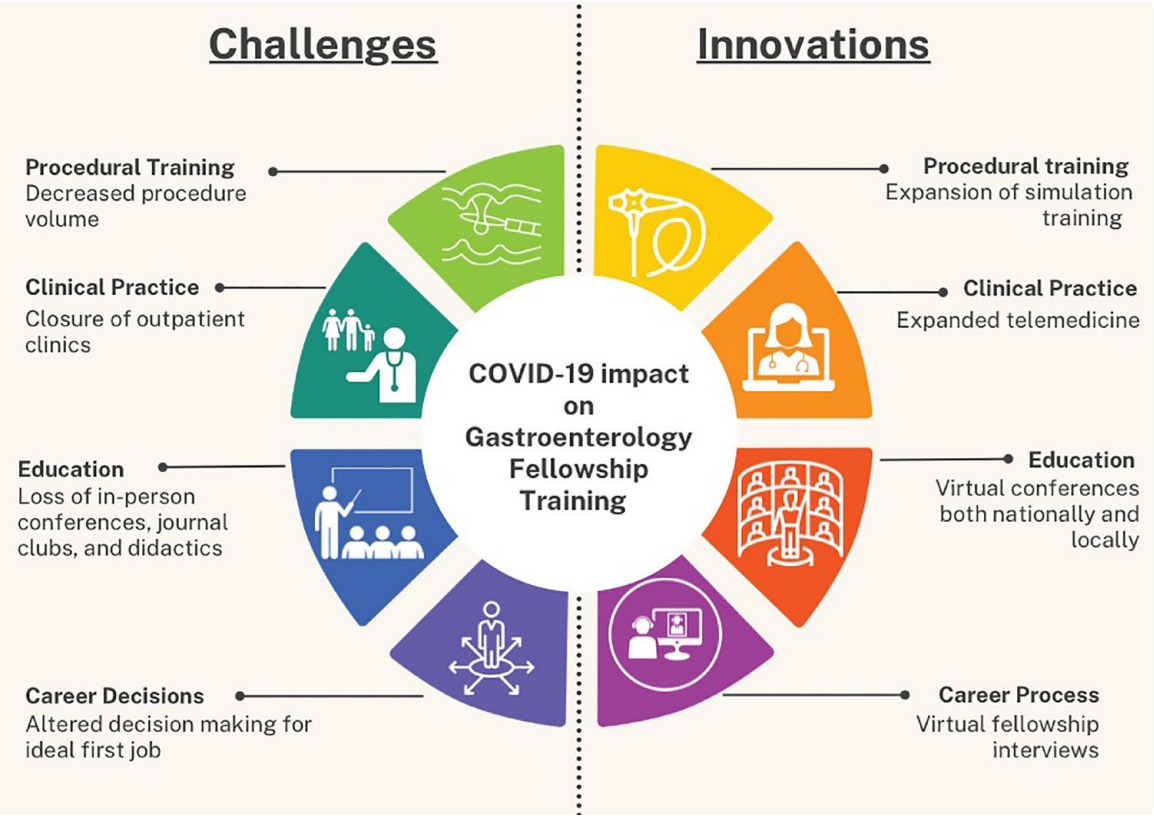

Figure 2. The impact of COVID-19 on gastroenterology fellowship training.

trauma that left them paralyzed in their personal lives.[20]

Our house staff were particularly susceptible to the impact of COVID-19 on their health and wellness. One study reported that lower training levels, female gender, and African American trainees had higher rates of depression among both students and house staff trainees.[38,39] In a web-based survey, gastroenterology fellows reported signs of anxiety (81%), concern for exposure (93%), concerns for prolongation (50%), and loss of concentration and interest (50%) because of the pandemic.[40] Key contributors to the development of burnout in this study included frequent policy changes, reduced number of patients in their desired field, limited personal protective equipment, and the forced deployment to COVID units and subsequent risk to loved ones. Program directors were not immune from similar effects; self-reported burnout increased significantly from 15.5% pre-pandemic to 44.7% during the pandemic, and most program directors witnessed minor signs of fellow burnout as well.[41]

Reconstruction

As the medical population enters this current phase, the long-term impact of this increased burnout, substance use, anxiety, and depression are potentially tremendous and are yet unknown. Future studies will be needed to assess the impact COVID-19 has on the wellness and mental health of our trainees as they enter the workforce.

Procedural training

While medical training for residents and fellows was impacted across all medical fields, procedural specialties endured additional and unique challenges (Figure 2). During the beginning of the COVID-19 pandemic, there was a broad stoppage of non-emergent surgical and endoscopic cases for upward of 3 months, and case volume remained decreased for many additional months.[42,43] Screenings, such as those for colorectal cancer, saw a particularly dramatic decrease for a protracted period of time. One retrospective cohort study from Kaiser Permanente noted not only a decrease in screening colonoscopies but also a decrease in other noninvasive modalities,

such as fecal immunochemical testing.[44] The consequences of delayed colorectal cancer screening are now being seen in an uptick of colon cancer diagnoses overall and an increase in later-stage disease.[45,46] The same study documented an 8.7% decrease in colorectal cancer diagnosis and a 26.9% decrease in advanced adenomas over this period.[46]

In addition to the clinical impact on our patients, the decreased volume of procedures directly impacts the training of gastroenterology (GI) fellows. While volume is not the only salient metric in developing competent endoscopists, the volume and variety of cases are important factors for a trainee's development of procedural skills. Multiple studies have assessed the direct impact of the pandemic on procedural training in gastroenterology.[47–50]

An internal survey of 770 GI trainees across 63 countries reported drastic reductions at the beginning of the pandemic in the overall number of procedures, with only approximately 10% of the typical procedural volume being performed across Europe and Asia.[43] In the United States, at the peak of the pandemic, there was an approximately 50% reduction in endoscopic procedures and inpatient consults across multiple programs. Clarke *et al.* reported that because of this decrease in procedures and consults, nearly two-thirds of trainees felt that COVID-19 had negatively impacted their endoscopic skills, with many trainees raising concerns about a possible need for extended training.[40] Trainees were often excluded from cases to preserve protective personal equipment and reduce the risk of viral exposure in aerosolizing procedures which further decreased the cases that trainees performed.[38,51,52] A separate review demonstrated that for the limited number of procedures performed, senior or advanced fellows were called upon to perform procedures instead of first-year fellows to facilitate speed and efficacy, potentially having a negative impact on the development of junior gastroenterology fellows.[53] Furthermore, the study by Kumar *et al.* found a significant disruption in first-year endoscopic training. In this study, first-year GI fellows at the University of Pennsylvania missed almost a quarter of endoscopic procedures that they would have otherwise performed in their first year.

Beyond the total number of procedures, the variety of procedures available to gastroenterology fellows also changed. As mentioned previously, screening colonoscopies and other non-emergent tests significantly decreased. One report from Turkey demonstrated that 96 gastroenterology trainees across[37] centers reported a significant decrease in independently performed endoscopic procedures as senior fellows, with specific reductions in diagnostic (91%), therapeutic (57%), and advanced endoscopy (65%) procedures.[54] Procedures that trainees already get limited training – such as esophageal manometry and pH testing – were decreased as well, potentially eliminating the chance for exposure to these subspecialized procedures for some trainees.[55–57]

The decrease in procedural volume also affected other medical field specialties. A study comparing pre- and post-pandemic experiences of surgical residents reported the pandemic significantly impacted their skills in laparoscopic surgeries, decreased cases throughout weeks, and a decline in the postgraduate pursuit of laparoscopic surgical fields.[58,59] To supplement these losses, surgical training programs expanded their hands-on simulation training.[59,60] Historically, gastroenterology fellowships predominantly have utilized endoscopy simulation at the start of procedural training rather than as a replacement for endoscopy.[61,62] Yet, COVID-19 brought about an expanded use of simulation and the incorporation of low-cost endoscopy trainers.[63,64] This adaptation attempted to mitigate the loss of procedural skill development particularly felt by junior fellows.

The ultimate impact of the decreased procedural volume on fellowship training is unknown. Pre-pandemic procedural volume has largely returned for many institutions, with a recent study demonstrating that 70% of gastroenterologists have returned to their pre-pandemic working schedule.[65] However, COVID-19 testing policies and the pandemic's continuation, characterized by acute and irregular increases in the number of COVID-19 infections throughout the country, have resulted in higher-than-normal cancelation rates. This variability in case volume may continue to impact gastroenterology trainees.

Clinical training

The COVID-19 pandemic also presented numerous obstacles in teaching how to care for patients with varied GI diseases in both inpatient and

outpatient settings. Anjum *et al.* observe that GI physicians and trainees had to adapt to new recommendations for the management of GI and hepatology conditions.[66] For instance, major hepatology and gastroenterology societies recommended offering telemedicine services, postponing surveillance scoping, utilizing more noninvasive assessments, and considering a reduction in the use of immunosuppression in some complex patients infected with COVID-19.[65,67] These recommendations evolved as we learned about the safety of immunosuppression and COVID-19 in select populations, gastroenterologist to stay up to date on the literature.[68]

The new advent of post-COVID gastrointestinal pathologies is also an example of the changing atmosphere in outpatient gastroenterology training. Many studies have reported an increased burden of incidental gastrointestinal disorders spanning several categories including motility, acid-related, functional pathologies, irritable bowel syndrome (IBS), dysbiosis, acute pancreatitis, hepatic, and biliary disease.[65,69] Choudhury *et al.* found GI symptoms to be present in 12% after COVID-19 and 22% as part of long COVID-19. The five most common GI symptoms of long COVID include the following: loss of appetite, dyspepsia, IBS, loss of taste, and abdominal pain.[69] Furthermore, Nakhil *et al.* emphasized that patients may develop post-COVID-19 disorders of the gut–brain interaction among hospitalized and ambulatory patients.[70] The long COVID gastrointestinal manifestations in hospitalized and non-hospitalized patients make post-COVID care training in the outpatient and telemedicine imperative for gastroenterology trainees.

Telemedicine rapidly became a popular and viable mechanism for the delivery of medical services. In the ACGME survey reported by Byrne *et al.*, the most significant disruptions by COVID-19 affected ambulatory clinical rotations, followed by inpatient admissions and the use of telemedicine.[6] In a follow-up ACGME survey reported by Hogan and Holmboe, gastroenterology was one of the non-frontline medical programs that heavily used telemedicine at the peak of the pandemic.[8] Telemedicine technology was one of the many developments that created clinical encounters and maintained a rapport with patients while also complying with government-imposed mandates of social distancing. In fact, while only 4% of pediatric GI programs in a national survey had fellows participating in outpatient telemedicine before COVID-19, 76% of programs utilized telehealth by the time of the survey in April 2020.[71]

After the temporary closure of outpatient clinics and endoscopic sessions, gastroenterology trainees increased their online and telephone consultations for patients, changing the approach to patient healthcare and accepting a new model of clinical service.[38,72,73] In one of the first studies from the US evaluating telemedicine in gastroenterology during COVID-19, Keihanian *et al.* reported an almost universal adoption of telemedicine, with approximately 88% of physicians reporting greater than 75% utilization in their centers.[74] Many training programs incorporated telehealth best practices into their training,[72] while medical schools integrated Objective Structured Clinical Examinations to teach medical students about telehealth.[75] As a result of these changes, the AAMC and ACGME announced that telemedicine would be a mandatory part of medical school and residency/fellowship training, respectively.[73,76]

The adoption of telemedicine in an outpatient setting, along with the changes in the inpatient setting, does not come without a compromise. While 90% of gastroenterology fellows' continuity clinics became virtual, there was a significant drop in their participation in additional Gastroenterology Attending Clinics; approximately 50% of fellow participation dropped due to shorter clinic appointments and lack of educational time.[74] Rotations in these clinics often provide a fellow's only exposure to gastrointestinal subspecialities including inflammatory bowel disease, motility, and nutrition. Beyond the decreased volume, other aspects of inpatient care directly impacted the learning environment of fellows including the reduced fellow staffing, limitations in entering patient rooms, remote rounds, and interruptions with redeployment to other services.[48,53,77] Between the decreased volume of cases and the decreased variety of consultations, trainees missed multiple educational opportunities during the COVID-19 era.

Educational conferences

Educational activities in gastroenterology fellowship typically involve in-person activities including didactics, case presentations, journal clubs,

and grand rounds presentations. Bedside teaching has also historically been a mainstay of clinical education during training. All such activities were disrupted by COVID-19 due to restrictions on the number of people who could gather and mandatory social-distancing requirements.

These restrictions led to a meaningful increase in the use of virtual presentations for fellowships across the country. Case presentations and didactics became virtual at individual programs, sometimes with increased faculty inclusion as faculty now could log in from different locations.[78,79] National Societies, including the American Gastroenterological Association and American College of Gastroenterology, expanded virtual presentations accessible to members across the country.[78,80] Alternative media allowed further dispersal of information, including the expanded use of podcasts and Twitter for structured educational events, such as #ScopingSundays and #MondayNightIBD.[81] Grand rounds presentations shifted to a virtual format, greatly decreasing cost, and increasing the ability for invited speakers to attend. Scientific conferences have evolved to include virtual options even now with the return of in-person conferences.[82] These shifts allow a larger share of the population, including those who may have been previously unable to participate in the kinds of events highlighted here, to access and engage in such educational forums.

Despite benefits, there may be some pitfalls to these changes. A shift toward virtual education may result in less personal contact and fewer networking opportunities. 'Zoom fatigue' has been reported and can potentially limit the utility of some conferences.[83] As trainees have educational sessions virtually and can participate at whatever site they are working at, often hospital and clinical distractions can encroach on protected educational time, potentially to the learners' detriment. The balance between in-person and virtual activities will need to be determined on the program-to-program basis, but virtual components are likely to remain going forward.

Future careers and the interview process

Even before the COVID-19 pandemic, there was a concern for a physician shortage, exacerbated by an aging US population. The pandemic has only heightened this problem with senior physicians more likely to retire early due to the COVID-19 pandemic than in prior years or than their younger colleagues.[7,84] A national, cross-sectional survey of the impact of COVID-19 on trainees during the pandemic showed that a significant minority had a decreased desire to continue pursuing the field of medicine. This was especially true for trainees with concerns about their personal health or who noted medical conditions in themselves or their families.[8] However, a majority of residents and fellow trainees in the same study above reported no changes in their desire to pursue medicine during the pandemic. While the increase in first-year students in US medical schools in the 2020 entering class was modest (1.7%), there was a large 18% increase in medical school applications for the 2021 academic year.[76] However, application rates for medical school in 2022 reverted to pre-pandemic rates.[85]

The pandemic does appear to have impacted the choice of specialty for medical students and trainees. The closing of medical examinations, restriction in away rotations, and limitations in performing sub-internships for fourth-year medical students created much uncertainty and led to alterations in career decision-making.[86] For example, one study found women and minority students were less likely to apply to orthopedic surgery residency, and many students (88%) reported having fewer opportunities to gain exposure in different fields and finalize their career decisions.[87] Candidates in 2021 also exhibited different features on their applications. Specifically, applicants for surgical specialties displayed a decrease in the number of honored clerkships, while showcasing a rise in the number of research submissions during the unraveling of the COVID-19 pandemic.[51] Students appeared to utilize their time effectively to build strong applications by different means despite alterations in clinical audition rotations.

One study evaluated the trends in US Internal Medicine (IM) residency and fellowship applications during the pandemic and found that the rate of increased applicants and applications submitted per applicant for IM residency and subspecialty fellowship increased in 2021, more than in the prior years. Infectious disease and pulmonary fellowships increased by 17% and 6.6%, respectively.[88] Interestingly, gastroenterology was the only medicine subspecialty fellowship with fewer applicants in 2021, though it was a slight decrease

of 0.3%. It is unclear if this decrease represents applicants taking a year off prior to applying to a competitive fellowship, a decreased interest in gastroenterology and hepatology, or is merely an aberration year-to-year. There does appear to have been a rebound in 2022 with the gastroenterology fellowship only having two unfilled programs compared to five unfilled programs in 2021 and 2020. Comparatively, specialties such as infectious disease, which saw a significant increase in applicants in 2021, now had 52 unfilled programs compared to only 41 unfilled programs in 2021.[89] Exact applicant numbers for 2022 were not yet available at the time of this article's authorship.

The interview process for fellowship was also dramatically altered. An article published by Mallepally *et al.* evaluated the challenges of prospective gastroenterology applicants and fellowship programs during the COVID-19 pandemic; applicants interested in GI had less research time, less time on GI electives, redeployment to other services, and reported an inability to build rapport with program faculty and fellows.[90] The loss of in-person scientific conferences limited the opportunity to network with fellows and program directors through scholarly work and in-person networking.

The pivot to virtual interviews, in addition to a shortened interview season given the postponed ERAS submission date, was an adjustment for applicants as well as programs. Noted challenges for programs included the training of faculty for virtual interviewing, the inability to showcase facilities, and the struggle to allow candid interaction between applicants and current fellows.[49,91] Many programs adapted by training faculty, creating a uniform approach to interviews, encouraging meet-and-greets with fellows, increasing interview slots, and building a presence on social media. Despite this, a survey of gastroenterology fellowship applicants and fellowship program directors after the 2020 interview season reported that 42.3% of all applicants viewed virtual interviews as suboptimal. One of the major issues was a reported difficulty creating interpersonal connections between applicants and the faculty interviewing them.[82] Similar feedback was given in evaluations of advanced endoscopy fellowship interviews.[79] Ultimately, this may have impacted how applicants and programs ranked each other.

Virtual interviews did have benefits. The cost-effective nature of virtual interviews can contribute positively to equity among applicants.[90] There were also more options through virtual interviews to apply across the nation. It also allowed for less complication of clinical coverage requirements and the ability to 'travel' to fellowships further away without time off.[82,90] As a result, there may be some regional diversification of where applicants can apply to and programs can recruit from. In fact, one study of the residency match among surgical specialties demonstrated an increased number of applicants who had no geographic connection to the program they matched to in 2021.[51,59] This is one suggestion that the virtual interview process may lead to regional diversification. However, virtual interviews and virtual tours may not be adequate for some residents and fellow applicants. Mallepally *et al.* hypothesized that the travel restrictions reduced opportunities for rising gastroenterology fellows to physically evaluate institutions, potentially making some applicants reticent to move away from familiar geographies in the future.

While not much is published, subjective reports suggest virtual interviewing has improved with each successive interview season and, despite limitations, virtual interviews offer benefits to applicants.[79,90] Future iterations of the match may have a hybrid component to interviews, where virtual interviewing is the mainstay of interviews but applicants are offered the opportunity for programmatic visits after the programs close their rank-list but prior to applicants close their list. Given its benefits, at least some component of virtual interviewing will likely be a mainstay of the application process going forward.

Career decisions

There is limited data examining the impact of COVID-19 on adult gastroenterology fellow career decisions. A few studies looked at the impact of COVID-19 on job aspects for pediatric gastroenterology fellows.[71,92–94] Sanchez *et al.* reported that when pediatric gastroenterology fellows applied for jobs during COVID-19, they focused on job attainment rather than other factors.[93] First jobs were chosen with fewer geographic restrictions, less negotiation over salary, less reported overall satisfaction with their selected position, and less interest in research-dominant positions.[82] In fact, the study reported

Table 1. Long-term impact of COVID-19 on trainees and future questions requiring study.

Impact of COVID-19	Future questions to be answered
Increased burnout, anxiety, and depression	• Will burnout at an early stage during training impact long-term outcomes in a career? • Will rates of anxiety and depression rise in the physician population in future years? • What resources will the ACGME and local institutions dedicate to combat these issues that were present pre-COVID but were worsened during COVID?
Decreased endoscopy case volume and clinical electives	• Is there an impact on new practitioners' quality benchmarks (i.e. Adenoma Detection Rates, Cecal Intubation Rates) that trained during the COVID-19 pandemic? • What is the role of endoscopic simulation moving forward? • What impact on career selection in gastroenterology subspecialities does this have?
Virtual conferences	• How do national societies balance the desire to be in-person with the increased access afforded by virtual conferences? • Will institutions continue to financially support attendance at conferences if a virtual experience is offered?
Virtual interviews	• How do programs balance the value of equity with the ability to demonstrate the intangibles of their program for applicants?

that most fellows anticipated a shorter duration for their first position, leading to concerns of increasing job turnover and decreased overall satisfaction. The pandemic also influenced approximately 31% of fellows to consider a fourth year of training, an increase from prior years.[71,92,94] It is unclear if this increase is truly a result of COVID-19, but the authors hypothesize that a reduced procedure rate or reduced exposure to subspecialities in gastroenterology may have contributed to a desire for a fourth year of training.

Future considerations

At this point of the COVID-19 pandemic, it appears we have entered the last phase of Zunin and Meyers' mode: Reconstruction. As we move forward, many unanswered questions remain for educators in medicine and gastroenterology (Table 1).

First is the long-term effect of this burnout on the workforce entering gastroenterology and hepatology. We have already seen short-term impacts on career choices and significant effects on mental health, but it is unknown whether this burnout and decline in mental health will lead to higher rates of early retirement, decreased career satisfaction, or longer-standing mental health issues among these providers. Consequences of burnout and mental health may also influence the pipeline of future gastroenterologists.

For the fellows trained during the COVID-19 pandemic that saw a decreased volume and diversity of cases, it is unclear what the impact on their clinical practice will be. Prior studies have shown that at the commencement of independent clinical practice, some quality metrics such as cecal intubation rates may have worsened.[95] It is possible that those currently entering practice may have a steeper learning curve to meet clinical quality benchmarks or may have increased rates of incomplete procedures or even complications because of their altered training. The decreased caseload seen as fellows may also impact their clinical competence in addressing less common complaints in practice. Assessing the long-term impact on clinical care provided by those trained during the pandemic is a potential area of study.

Not all changes necessitated by the pandemic are negative. The expansion of telehealth and subsequent reimbursement from insurance dramatically increases access to patients who have difficulty traveling for a multitude of reasons, including childcare issues, the inability to take

time off work, long distances required to travel in rural settings, and comorbidities that make traveling to an office visit difficult. Along these lines, virtual interviews increase the equity among applicants for medical schools and training programs across the country. New educational conferences, collaborations, and virtual learning may also increase participation for those deprived of specific training or for those who could not attend a conference due to specific constraints. While these changes were made out of necessity, the utility of these changes cannot be discounted.

Conclusion

COVID-19 dramatically impacted the everyday life of medical educators and trainees. The challenges educators experienced changed as the pandemic evolved, although many of the negative effects of COVID-19 may linger with our community for years to come. Other opportunities arose that will also be incorporated into our programs going forward – a focus on wellness and the mental health of our trainees, incorporating telehealth for patients, and virtual platforming for educational activities and interviews are areas of growth for us to continue expanding upon. As training programs move forward, we will be challenged to continue addressing both the positive and negative changes that COVID-19 had on medical education.

Declarations

Ethics approval and consent to participate

This review did not include any patient/guardian/participants. Consent and IRB were not applicable.

Consent for publication

This review did not include any patient/guardian/participants. Consent was not applicable.

Author contributions

Salima Makhani: Conceptualization; Data curation; Investigation; Methodology; Visualization; Writing – original draft; Writing – review & editing.

Jaclyn Morales: Data curation; Investigation; Validation; Writing – review & editing.

Matthew J. Whitson: Conceptualization; Data curation; Investigation; Methodology; Supervision; Validation; Writing – original draft; Writing – review & editing.

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