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REVIEW ARTICLE

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How Our Hematology/Oncology Fellowship Evolved in Response to the COVID-19 Pandemic in Case Western Reserve University

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ABSTRACT

In 2020, the Accreditation Council for Graduate Medical Education (ACGME) released a set of guidelines of how to approach the changing landscape of education within residency and fellowship programs in the post-COVID era. This toolkit gave guidance to programs regarding how they could best serve their residents/fellows, while also providing excellent patient care without compromising educational opportunities. COVID-19 has impacted the way we approach post-graduate medical education forever. Many fellowships across the country, including hematology/oncology, have adapted their didactics, and program structure to best accommodate their learners' needs. Hematology/Oncology fellowship and training requires a strong set of didactic curricula, bone marrow biopsy training, fellow continuity clinics, and close collaboration with other specialists. In response to the pandemic, our hematology/oncology program at UH Seidman Cancer Center sought to make changes in the overall structure of the fellowship, didactics, bone marrow biopsy training, board review preparation, mentorship, and wellness to further support our fellows in a new era of learning.

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Introduction

The COVID-19 global pandemic has reshaped approaches to graduate medical education in many ways. Residency and fellowship programs across the nation have had to adapt their curricula, didactic sessions, and patient care models to best serve their resident physicians' training and provide support to the hospitals they serve as well [1]. Henry Ford Hospital, MD Anderson Cancer Center, Memorial Sloan Kettering Cancer Center, and Dana Farber Cancer Institute are four of the only fellowship programs to have published their experiences between 2020-2021 and what their adjustments to their program were as a result of the pandemic. Many new innovations involving virtual platforms in patient care, curricula, and didactic are now becoming the norm in many residencies and fellowship programs in the post-COVID era [2-5]. Velazquez et al. published an article in JCO 2022 that surveyed 103 hematology oncology program directors across the United States and found that many programs reported increased burnout among fellows (15.5% to 44.7% pre and post pandemic respectively), reduced career development opportunities, and decreased engagement as a result of the transition of fellowship activities to virtual learning. In addition, programs reported limited research opportunities, decreased fellowship funds, and concerns regarding virtual recruitment as well [6]. As a community of trainees, program directors, and teaching attendings, we must continue to collaborate and share our work to improve upon hematology/oncology trainee education in the post-COVID era. Here, we share our program's experience in adopting a new fellowship structure in response to the COVID-19 pandemic with many changes made between 2020 to 2022.

Literature review

Fellowship structure prior to 2020

The Case Western Reserve University/University Hospitals Hematology/Oncology Fellowship in Cleveland, Ohio is a three-year combined hematology/oncology training program that incorporates training at MetroHealth Medical Center, the Cleveland Louis Stokes VA Medical Center, and the main academic center, University Hospitals Cleveland Medical Center (UH). The program accepts four fellows per year. Prior to 2020, the program provided coverage for the combined hematology/oncology consultation services at MetroHealth and the VA Medical Center in addition to providing coverage for the hematology consultation service, oncology consultation service, bone marrow transplant inpatient service, and malignant hematol-

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ogy inpatient services at UH. In the outpatient setting, fellows were assigned one half-day of continuity clinic at MetroHealth or the VA, where they are designated as the primary oncology provider under the supervision of a general oncology attending. In addition, fellows would rotate in their second and third years of fellowship in various subspecialty clinics of interest with the last eighteen months focused on developing their own research projects and protocols in preparation for finding their first attending role.

Update to didactics

A large challenge for many fellowship programs during COVID was the suspension of in-person didactics. Our program, like many other programs across the country, transitioned all didactics to a virtual format and have slowly re-incorporated our didactic lectures in person still with a virtual option. This has allowed those with varying levels of comfort to assess their own benefits/risks of attending in person and it has allowed those fellows off-site at the VA or MetroHealth to still be part of our didactics as well. It has also connected attendings at three different institutions to be part of our lectures and journal clubs and offer unique perspectives based on each of their own practice settings as well. In response to the COVID-19 pandemic at UH, the program helped create a treatment guideline and protocol to manage anticoagulation and thrombosis in COVID-19. Many of these cases were brought to our nonmalignant hematology weekly case conference, where fellows present two to three challenging hematology cases with experts and other fellows. In addition, we felt that moving our main campus didactics to one day per week for a total of three hours would help increase attendance, camaraderie, and allow fellows to interact more with each other and faculty during a period of isolation. To help facilitate these goals further, we moved to faculty-led hematology/oncology lectures and fellow-led journal clubs, multidisciplinary conferences, or hematopathology case conferences. To meet the needs of a graduating fellow, we also incorporated a new monthly faculty/fellow-led board review course as well. The program also purchased fellows ASCO-EEOF (Educational Essentials for Oncology Fellows) and ASH-FHF (Fundamentals for Hematology Fellows) along with a virtual board review course to have flexibility for self-directed learning as well. At our two partner sites, we incorporated a biweekly session with a hematopathology expert at MetroHealth with over 50 years of experience in examining blood smears, bone marrow biopsies, and working through a structured case-based curriculum regarding basic hematology concepts tested on the hematology board exam. At the VA, the program incorporated a biweekly fellow case conference, a monthly coagulation case conference, and monthly faculty led ASH/ASCO review. The feedback received by the fellows found that the majority of teaching faculty and fellows found these changes favorable and felt it had positively impacted the fellowship (Table 1).

Table 1. Summary of didactics changes as a result of covid19 pandemic.

University Hospitals (UH)	Metro Health Medical Center	Louis Stokes VA Medical Center
Benign Hematology Conference to include discussion of difficult COVID cases	Biweekly Hematopathology Review/Conference	Biweekly Fellow Case Conference
Condensed Didactics to Fridays for 3 hours with Oncology Grand Rounds, Journal Club, and Faculty Led Lectures	Morbidity and Mortality Conference	Monthly Coagulation Conference
Hematopathology Joint Case Conference	MKSAP Hematology/Oncology Board Review for Residents	Faculty-Led ASCO/ASH Review
Structured Board Review using Question Bank from HemeOncQuestions.com	Hematopathology Conference	Morbidity and Mortality Conference
ASCO-EEOF and ASH-FHF purchased by program annually		

Update to rotation schedule

To better meet the needs of our own hospital in response to COVID-19 pandemic and to meet the needs of our own fellows with varying interests, we decided to adopt a new rotational system with changes made over a period of two years from 2020-2022. The feedback received from our fellows conveyed that there was general dissatisfaction with the traditional solid oncology consult service which was present prior to 2020. The service consisted of one attending and one fellow covering all solid oncology consults. It was felt that given the growing number of subspecialists at our institution, we could better serve our patient's individual needs, decrease the overall amount of consultation

time required for each individual attending, and provide more expert level education for our fellows by adopting a "disease-specific fellow/attending model." We then implemented our disease specific solid oncology consult service, where four fellows would cover Gastroenterology (GI), breast, thoracic, and Genito Urinary (GU) consultations and other inpatient subspecialties (sarcoma, melanoma, neuro-oncology, head/neck) would be co-covered by the same four fellows as well (Table 2). Each fellow would rotate on each "disease-team" for 8-12 weeks at a time.

Table 2. Summary of university hospitals fellowship structure changes (2022).

Services	Fellow Structure/Role Prior to 2022	Fellow Structure/Role as of 2022
Hematology Consult Service	1 fellow for two weeks	No change
Oncology Consult Service	1 fellow for two weeks	4 fellows each covering one of the following subspecialties for 3 months (GI, thoracic, GU, and breast) • Co-coverage of melanoma, ENT, and CNS consults
BMT Inpatient Service	1 fellow for two weeks with primary patient care responsibilities	1 fellow for six weeks with primary patient care responsibilities
Malignant Hematology Inpatient Service	1 fellow for two weeks with primary patient care responsibilities	1 fellow for six weeks without primary patient care responsibilities

During this time, fellows are required to attend one half day of their normal continuity clinic, two half days of clinic in their subspecialty rotation, disease specific tumor boards, and clinical trial meetings. The rationale behind this is to expose 1st and 2nd year fellows to the "big four" solid oncology specialties which include Gastroenterology (GI), breast, thoracic, and Genito Urinary (GU) cancers and the specialties that cover a large majority of the ASCO In-Training Exam (ITE). In addition, we felt that continuity of care from a patient, fellow, and attending perspective would be much improved and fellows and faculty would get to know one another very well and have more time for research and rest on their off days as well during this three-month period.

Updates to malignant hematology/bone marrow transplant service

Our UH site has an inpatient malignant hematology service and bone marrow transplant (BMT) services which are staffed by advanced practice providers (APPs) and fellows providing primary patient care responsibilities. These services are the only primary patient responsibilities fellows will receive during their fellowship. Fellows historically would be assigned three to six patients on each service prior to 2022. Our program felt that to have a full immersive experience in malignant hematology and bone marrow transplant but also maintaining fellow well-being we needed to reduce the primary patient care responsibilities of the fellow on the malignant hematology service. As a result of this, fellows now act as "junior attendings" on the malignant hematology service without primary patient care roles. It was felt this change would allow fellows more time to dedicate themselves to learning chemotherapy regimens, performing bone marrow biopsies, and attending other meetings- such as tumor boards, transplant meetings, graft versus host (GVHD) rounds, clinical trial/research meetings as well. In addition, we also changed the structure of the rotation to now consist of six weeks of malignant hematology and six weeks of bone marrow transplant. Fellows are to be on call only once per week and only work one weekend per month during this time as well. The bone marrow transplant service would still be the only service that would maintain primary patient care responsibilities given its unique high acuity nature. It was felt by our program that direct patient care was the best way for fellows to learn how to navigate the transplant process, become familiar with conditioning regimens, and take care of complications of transplant firsthand.

Bone marrow biopsy training

Many fellowship programs across the country do not have a standardized way to teach bone marrow biopsies and the traditional mantra has been "see one, do one, and teach one." Many fellowship programs are now incorporating mannequins, cadaver, or 3D printed models for fellows to practice their skills. Case Western Reserve University is one of the 1st medical schools in the country to incorporate HoloAnatomy mixed-reality learning for anatomy training for their first-year medical students. A randomized study published in JAMA September 2020 confirmed that medical students did prefer mixed reality for learning anatomy and subsequently scored higher on their testing as well [7]. As a result of this, we were the first hematology/oncology program in the country to incorporate mixed-reality

training for bone marrow biopsies. The pre-workshop results showed that the average comfort level with performing a bone marrow biopsy was 1.4 (graded from 1-10) and post-training revealed this increased to an average of 5. The pre-test average score for correctly identifying the chronological order of steps of performing a bone marrow biopsy was 54% (range 43%-71%), while the post-test results revealed the average increased to 80% (range 43%-100%). All five participants also felt that the combination of virtual reality and mannequin training led them to becoming more comfortable with the procedure than mannequin training or live training alone. This will become a standard part of our fellowship bootcamp curriculum moving forward. We feel that we now have objective evidence that the combination of mannequin and mixed reality anatomy training can further improve and augment a fellow's learning experience in performing a bone marrow biopsy.

Discussion

In 2021, we created three discrete tracks for the fellowship: the academic track, the clinical track, and the research track to better distinguish each fellow and tailor their schedules to their future career in the second and third years of fellowship. We felt that by distinguishing individuals based on their overall career trajectory, the fellowship could better help guide each individual fellow regarding schedule selection, research opportunities, and identifying mentors early.

- The **Clinical Track** is designed for fellows who intend to pursue a primarily clinical career, such as community oncology. During the fellow's third year of fellowship, they will continue to rotate through disease teams, with additional clinics and focus on elective teams to maximize clinical expertise.
- The **Academic Track** is our most popular track for fellows pursuing careers in clinical research, clinical trials expertise, and/or medical education. The goals of the academic track are to ensure sufficient, broad exposure for learning and board eligibility, but also an opportunity to focus on a specific subdiscipline and prepare for a career as a subspecialist in an academic setting. The third year of training may be primarily focused on a specific disease specialty to prepare fellows to transition to an attending with a subspecialist focus.
- The **Clinician Scientist Track** is for fellows pursuing primary research careers. After completion of core clinical rotations, fellows on this track maintain only a continuity clinic and dedicate additional time to laboratory or other translational research. Fellows may declare for this track, but a letter of support from a primary research mentor indicating sufficient laboratory support is required. Research efforts should lead to the submission of grants during fellowship for funding to further support an independent research career.

Mentorship/research

Mentorship is a crucial piece to research and career development in oncology and another pillar our program hoped to improve upon based on feedback received from fellows from previous years. Obtaining correct mentorship in a new hospital system can be overwhelming and many fellows struggle to find mentors given their initial unfamiliarity with attendings, hospital environment, and available resources. In 2022, we designed a formal mentorship program after an interview with each fellow to identify their specific interests and career trajectory. The chief fellows then assigned fellows mentors based on their personalities, research interests, and overall perceived compatibility and academic versus community interest. Mentors and mentees are to meet every three months and answer a set of standardized questions regarding a variety of structured topics including: wellness, research projects, community versus academic interests, and education.

Our trials and tribulations in wellness

To decrease the number of after-hour calls fellows were receiving, we first analyzed the amount of calls over a two-month period from April to June of 2022 and tracked when the peak number of calls were during the day. There was a total of 661 calls during this time with 66% of calls coming during weekdays and 34% during weekends. The busiest times for weekday calls were at 8am (20% of weekday calls) and 5pm (23% of weekday calls) respectively (Figure 1). Between 8pm-11pm on weekdays, we found that 16% of weekday calls came to fellows during this time. Saturday was the busiest day of the week consistently with 20% of all calls. The busiest times for weekend calls were from 8am-12pm (Figure 2), which is a key time for fellows working on inpatient rotations that are handling urgent consultations and active patient care. The program identified that improving fellow weekday and weekend call coverage support was an area of improvement for fellow satisfaction. Our program was able to secure hospital leadership support and were able to hire additional nursing triage line to help co-cover calls until 11pm during weekdays and until 5pm on weekends. This implementation decreased the number of calls received by fellows by an average of 3.8 calls per weekday and 15 calls per weekend, helped with fellow workflow, and increased general satisfaction of fellows within the program. Many fellows felt separated from one another given our unique structure of three fellowship training sites and the subsequent adoption of virtual conferences. In 2022, we incorporated a monthly

informal journal club we call "Blood Club," where fellows and faculty members would discuss an article in an informal setting over dinner at a faculty member's house or nearby local restaurant. These events were well attended and improved camaraderie amongst the fellowship. This past year we also created a new fellowship Instagram and Twitter to highlight fellowship social events and achievements along with a new fellowship recruitment video to highlight several key faculty members and chief fellows regarding their experiences with the program as well. In 2022, we also designed and created a new fellowship website that connected all three fellowship sites with contact information, resources, conferences, and calendar events at each site. It was designed to help connect faculty from each fellowship site keep up to date with the fellowship and changes we were implementing as well. Within the website, we incorporated an anonymous feedback feature in addition to available tools in the residency management software, where fellows can convey any concerns to the chief fellows without communicating directly to the program administration. Chief fellows can relay issues to program directors at regular engagement meetings. The program added an optional interaction with program directors monthly to discuss any concerns, questions, or areas of improvement regarding the fellowship as well.

Jeopardy system

One obstacle that many programs faced during the pandemic was the loss of staff because of fellows that fell ill with COVID-19 or had to isolate for five to ten days at a time. of Several times during the COVID-19 pandemic, there would be multiple fellows that fell ill which led to multiple disruptions in clinical rotations and was a source of dissatisfaction amongst fellows. To combat this, we adopted a more comprehensive "jeopardy" or backup system in the case of multiple fellows falling ill. We now have one "jeopardy fellow" who would be on a research block without any daily clinical responsibilities. With the incorporation of our new disease specific solid oncology system, we now have the ability to "flex" or re-direct one to two additional fellows temporarily on solid oncology consultations to other services given the lower numbers of inpatient consults when split amongst four fellows.

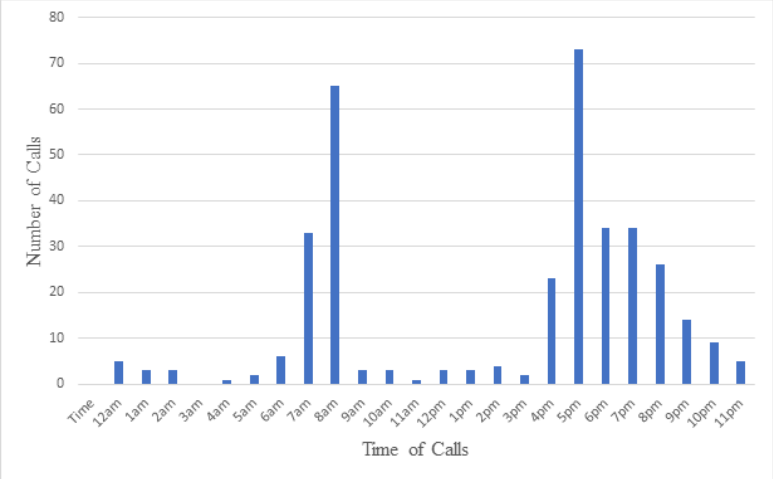

Figure 1. Total weekday calls april-june 2022

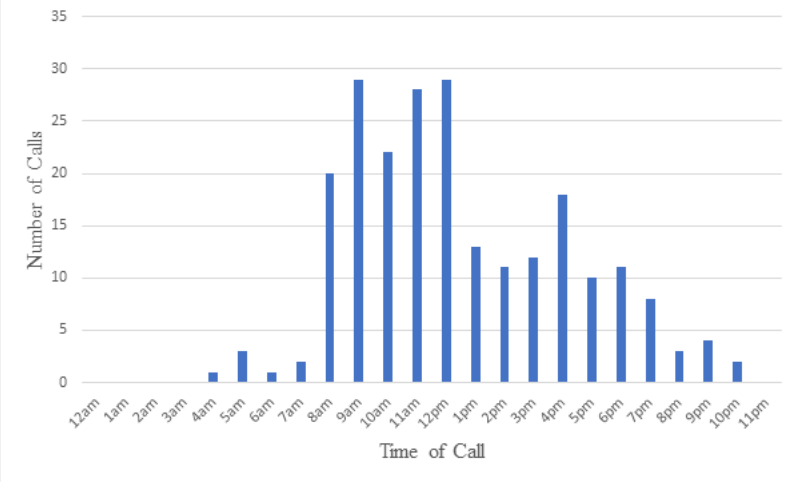

Figure 2. Total weekend calls april-june 2022

Conclusion

In conclusion, the COVID-19 pandemic has led to many changes in the way we approach graduate medical education. In adapting hematology/oncology fellowships of the future, we believe programs should focus on the following seven core values moving forward.

1) Continue to encourage hybrid online/in-person models for didactics

2) Consider using mixed reality learning for bone marrow biopsy training

3) Consider transitioning general oncology services to subspecialty specific services if sufficient number of subspecialty providers are present at one's home institution

4) Prioritize the well-being and opportunities for fellows by creating wellness activities for all fellows and faculty to attend

5) Programs should consider investing in board review material such as ASCO-EEOF and ASH-FHF and creating formal board review program

6) Create "tracks" to help identify fellow's trajectories earlier and establish formal mentorship program

7) Consider creating nurse triage line or expanding hours to help decrease number of after-hours calls on fellows

Conflicts of Interest

The authors have no conflicts of interest to report.

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