

Impact of COVID-19 on Hematology-Oncology Trainees: A Quantitative and Qualitative Assessment

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QUESTION ASKED: How did the COVID-19 pandemic affect hematology-oncology (HO) trainees?

SUMMARY ANSWER: HO trainees reported reduced research productivity and increase in burnout related to the COVID-19 pandemic.

WHAT WE DID: We conducted a mixed-methods study using a survey of Likert-style and open-ended questions to assess the training experience and well-being of HO trainees during the COVID-19 pandemic.

WHAT WE FOUND: We found that 59% of HO fellows reported reduced research productivity and 22% reported new symptoms of burnout attributable to the COVID-19 pandemic (Fig.).

BIAS, CONFOUNDING FACTOR(S): This study is limited by low a survey response rate of 24%, and there may be populations of trainees not captured in our analysis. Additionally, since we did not collect data on race, ethnicity, or program location, we were not able to

determine whether our findings were equally distributed across demographic groups.

REAL-LIFE IMPLICATIONS: These findings provide first-hand account of the impact of the ongoing COVID-19 pandemic on HO trainees and provide an essentially foundation for the development of programs and interventions to improve the trainee experience as the pandemic progresses.

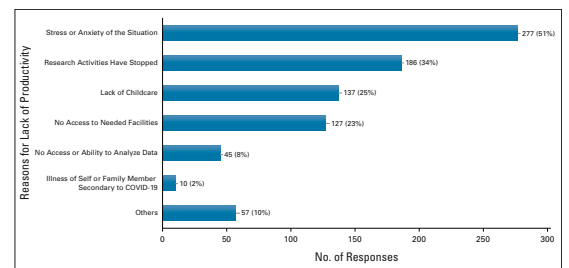


FIG. Reasons for reduced productivity during the pandemic.

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ASSOCIATED CONTENT

Data Supplement

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Impact of COVID-19 on Hematology-Oncology Trainees: A Quantitative and Qualitative Assessment

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abstract

PURPOSE Graduate medical and research training has drastically changed during the COVID-19 pandemic, with widespread implementation of virtual learning, redeployment from core rotations to the care of patients with COVID-19, and significant emotional and physical stressors. The specific experience of hematology-oncology (HO) fellows during the COVID-19 pandemic is not known.

METHODS We conducted a mixed-methods study using a survey of Likert-style and open-ended questions to assess the training experience and well-being of HO fellows, including both clinical and postdoctoral trainee members of the American Society of Hematology and ASCO.

RESULTS A total of 2,306 surveys were distributed by e-mail; 548 (23.8%) fellows completed the survey. Nearly 40% of fellows felt that they had not received adequate mental health support during the pandemic, and 22% reported new symptoms of burnout. Pre-existing burnout before the pandemic, COVID-19–related clinical work, and working in a primary research or nonclinical setting were associated with increased burnout on multivariable logistic regression. Qualitative thematic analysis of open-ended responses revealed significant concerns about employment after training completion, perceived variable quality of virtual education and board preparation, loss of clinical opportunities to prepare for independent clinical practice, inadequate grant funding opportunities in part because of shifting research priorities, variable productivity, and mental health or stress during the pandemic.

CONCLUSION HO fellows have been profoundly affected by the pandemic, and our data illustrate multiple avenues for fellowship programs and national organizations to support both clinical and postdoctoral trainees.

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INTRODUCTION

The COVID-19 pandemic dramatically altered postgraduate medical and research training, with rapid changes to educational and clinical environments and professional development opportunities. Beginning in March 2020 with the widespread implementation of social distancing, graduate medical education (GME) programs turned to virtual education via video conferences to continue core didactic lectures.¹⁻⁴ Many clinics and consult services converted to telehealth teams to minimize direct patient contact and potential spread of COVID-19.^{5,6} Elective surgeries were indefinitely delayed and resulted in a precipitous drop in surgical resident case volume,⁷ with one study of trainees in New York City finding a 74% decrease in cases at the height of the pandemic.⁸ Trainees in COVID-19 hotspots across the country were removed

from their regular rotations and redeployed to the care of patients with COVID-19.^{8,9}

In parallel, hematology and oncology (HO) research groups experienced reduced staffing capacity, laboratory shutdowns, lost research animal colonies, funding limitations, and travel restrictions. In response to the drastic changes in training during this public emergency, the American College of Graduate Medical Education developed a Three Stages guidance statement, which loosened or suspended several core program requirements.¹⁰ Per the statement, postgraduate training requirements that remained in place included adequate resources and training, adequate supervision, work hour requirements, and fellows functioning in their core specialty. However, these recommendations primarily addressed program accreditation concerns rather than trainee-generated issues.

Author affiliations and support information (if applicable) appear at the end of this article.

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Trainee responses to the dramatic changes within GME have only been sporadically reported, with some trainees noticing a decline in teaching and other trainees finding virtual education to be beneficial. However, a growing body of research suggests that trainee mental health has been negatively affected during the pandemic, with increased rates of burnout and anxiety that merit urgent mitigation.¹¹⁻¹³

HO fellows represent a unique group of trainees who were directly and indirectly affected by the pandemic. From redeployment to COVID-19 services, to decreased outpatient cancer visits, to witnessing the devastating impact of COVID-19 on patients with cancer, HO fellows experienced dramatic changes to their practice, education, and research training.^{14,15} The American Society of Hematology (ASH) and ASCO conducted a survey of all trainee members to understand the multifaceted impact of the pandemic on the well-being, education, research, and clinical training of postgraduate HO trainees.

METHODS

Survey Design

A survey to assess trainee pandemic-related experiences was developed by the ASH Committee on Training and the ASH Trainee Council and approved by the ASH Executive Committee. Demographic information included questions on sex, degree, year in training, country of residence, and visa status. Questions were in Likert-scale, multiple choice, and open-ended text formats; the full survey is available in the Data Supplement (online only). We used a single item from the Maslach Burnout Inventory that has previously been validated in medical personnel and comparable to the Maslach Burnout Inventory-Emotional Exhaustion single-item measure.¹⁶ The electronic survey was created in the QuestionPro online survey software (Survey Analytics LLC, Austin, TX). Respondents received a \$10 gift card for completing the survey. Topics explored included the following.

Baseline demographics: Sex, credentials, country of residence, type of training program, visa status, year of fellowship, and board certification plans.

Impact on training: Type of work, telemedicine, redeployment, professional activities, productivity, and career plans.

Trainee well-being concerns: Burnout, research funding, clinical competence, salary reductions, grant opportunities, loss of networking, loss of job opportunities, career changes, and family well-being.

Open-ended questions were incorporated to allow trainees to offer advice for other fellows and suggestions for how fellowships, institutions, and professional societies can support trainees.

Study Population and Survey Distribution

Survey invitations were e-mailed to all trainees listed as MD (clinical fellow) and PhD (postdoctorate) members of ASH and ASCO. Trainees not listed as members with an active e-mail

address were excluded from the study. The survey was open for responses from May 26, 2020, to August 19, 2020.

Data Analysis and Outcomes

Primary outcomes of interest were the prevalence and scope of impact of COVID-19 on two major areas: training logistics (clinical work, redeployment, telemedicine, education, and professional activities) and well-being (burnout, worry about funding, productivity, grant opportunities, career, and family). A qualitative analysis of trainee-provided feedback was also conducted.

Responses were analyzed using descriptive statistics. Univariable and multivariable logistic regressions were performed to evaluate the effect of demographics and COVID-19–related work on burnout. Quantitative analysis was performed using STATA Version 16 (StataCorp, 2019. Stata Statistical Software: Release 16. College Station, TX: StataCorp LLC). Qualitative analysis of open-ended responses was performed using a general inductive approach with NVivo software (Version 12, QSR International Pty Ltd, 2018).¹⁷ Thematic analysis revealed broad themes and subthemes from responses.

Institutional Review Board Approval

The institutional review board at Mayo Clinic (Rochester, MN) found this study to be exempt from review.

TABLE 1. Demographic Characteristics of Study Participants

Participant Characteristics	No. (%)
Sex	
Male	263 (49)
Female	272 (50)
Professional credential	
MD, DO, or equivalent	406 (75)
MD-PhD or DO-PhD	53 (10)
MD or DO with other degree	45 (8)
PhD	37 (7)
Clinical fellowship	495 (90)
Nonclinical fellowship	53 (10)
Primary specialty work area	
Adult HO	447 (82)
Pediatric HO	67 (12)
Research/nonclinical	60 (11)
Current year in fellowship	
First	142 (26)
Second	203 (37)
Third or more	199 (37)
Visa holder	
Yes	106 (19)
No	442 (81)

Abbreviations: HO, hematology-oncology.

RESULTS

A total of 2,306 surveys were distributed to fellows by e-mail during the study period, of which 620 (26.9%) participants responded and 548 (23.8%) completed all survey components required for inclusion in the analysis. Demographic characteristics of survey respondents are displayed in Table 1 and reveal an even distribution of sex among study participants, 84% with a clinical doctorate, 90% currently in a clinical fellowship, and the majority in adult HO. First-, second-, and third-year fellows were evenly represented. Almost one fifth of respondents were currently holding a visa.

Quantitative Analysis of Fellows Surveys

Participant answers to Likert five-point scales for the survey questions are summarized in Figure 1.

COVID-19–Related Work

Of the 548 participants, 25% (137 of 548) reported being involved in COVID-19–related clinical work, whereas 8% (42 of 548) reported being involved in COVID-19–related nonclinical work (COVID-19–related work that does not involve seeing patients face-to-face). As shown in Figure 1, only 65% of participants agreed or strongly agreed that they had received adequate personal protective equipment (PPE) during the COVID-19 pandemic.

Career Concerns

Survey respondents were concerned about obtaining a job offer (58%, 316 of 536) because of the pandemic and were also concerned about lower starting salaries (68%, 365 of 537; Fig 1). Most trainees reported concern about the availability of networking events for mentorship and job opportunities (73%, 391 of 538). Eighteen percent (93 of 534) of participants reported considering changing their career plans and 7% (39 of 548) had already changed career plans because of COVID-19 (data not shown).

Fellowship Training Concerns

Worry about the quality of education and clinical training was expressed by 54% of participants (291 of 539) during the pandemic (Fig 1). Fewer trainees were concerned about passing their board examinations (29%, 155 of 536) or completing training on time (23%, 125 of 538). However, 43% of participants (233 of 539) expressed concern about their clinical competence.

Research and Productivity Concerns

Reduced research productivity during the pandemic was a concern for 59% (321 of 539) participants (Fig 1). Additionally, 35% (191 of 540) worried about research funding, and 43% (229 of 536) about the success of future grant applications. Approximately 47% (251 of 539) of

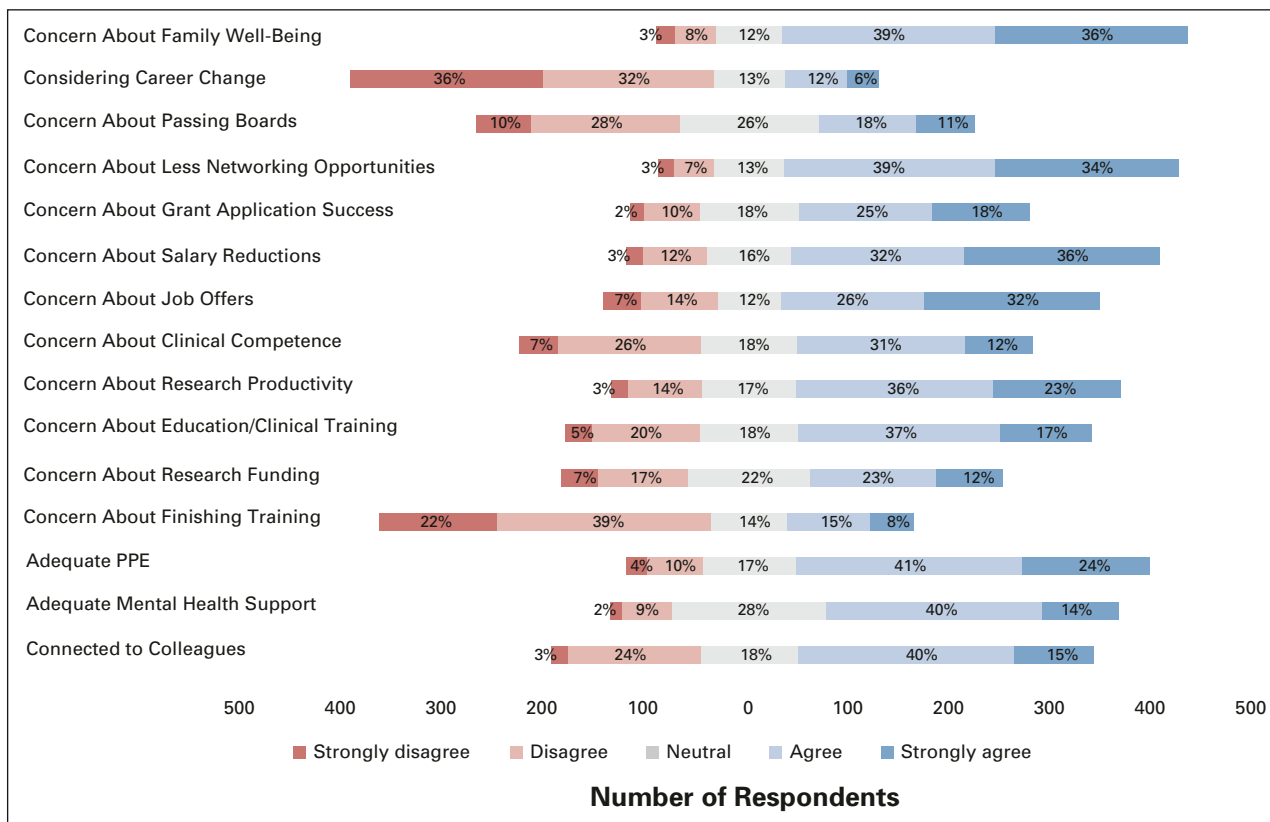


FIG 1. Summary of Likert five-point scale answers to survey questions. PPE, personal protective equipment.

participants felt less productive during the pandemic, and [Figure 2](#) summarizes respondent reasons for reduced productivity, with the majority attributing it to pandemic-related stress or anxiety.

Mental Health and Burnout

A sense of inadequate mental health support during the pandemic was expressed by 39% (214 of 539) of survey respondents ([Fig 1](#)). Moreover, 22% (93 of 426) of participants who reported no burnout symptoms before COVID-19 reported new symptoms of burnout since the pandemic began. The majority of survey trainees did, however, agree or strongly agree (54%, 293 of 539) to feeling connected with their colleagues, despite the pandemic ([Fig 1](#)). Family well-being was also a concern for most participants (75%, 402 of 537).

Predictors of symptoms of burnout among study participants were analyzed in logistic regression models ([Table 2](#)). Pre-existing burnout before the COVID-19 pandemic was associated with a much higher odds ratio (OR) of burnout during the pandemic (OR, 10.7; 95% CI, 6.38 to 18.2; $P < .001$) in the multivariable analysis. The multivariable analysis also revealed that involvement in clinical COVID-19 work (OR, 2.33; 95% CI, 1.42 to 3.82; $P = .001$) and working primarily in a research nonclinical job (OR, 2.54; 95% CI, 1.13 to 5.68; $P = .023$) were also significantly associated with worse burnout during the pandemic compared with no additional COVID-19 work or working primarily in a clinical job. The univariable analysis revealed a higher odds of burnout for women and fellows in their third-or-higher year of training, although these did not remain significant in multivariable analysis.

Country of Work and Visa Holders

Approximately 96% (528 of 548) of respondents were from the United States, with the majority of non-US respondents

(3%, 16 of 548) located in Canada. Nearly 20% of respondents were visa holders, with 29.2% (31 of 106) visa holders reporting issues with their visa during the pandemic.

Qualitative Analysis of Fellow Surveys

Of 621 completed surveys, 534 included responses to the open-ended questions. The broad themes identified in survey responses included concerns about finances, education, professional and career development, research activities, overall productivity, mental health, and institutional and programmatic support. Subthemes within each broad theme were identified and are summarized in [Table 3](#) with representative survey quotations included. [Table 3](#) also includes recommendations that fellows provided on how concerns could be addressed by their institutions or national organizations such as ASH and ASCO.

Financial Concerns

Overall, financial constraints affected multiple facets of fellows' personal and professional lives. For some trainees, financial support for master's programs and research summer programs had declined because funding was prioritized for other departmental expenses. Furthermore, budget cuts jeopardized faculty positions for the graduating fellows, particularly for fellows who are visa holders, and funding for travel and conferences had been suspended.

Educational Concerns

Most fellows indicated that COVID-19 clinical responsibilities superseded routine clinical rotations, and fellows expressed uncertainty about whether they would be allowed to take time out of the elective portions of the fellowship to complete core clinical rotations in the future. At some institutions, fellows were redeployed to general medicine inpatient

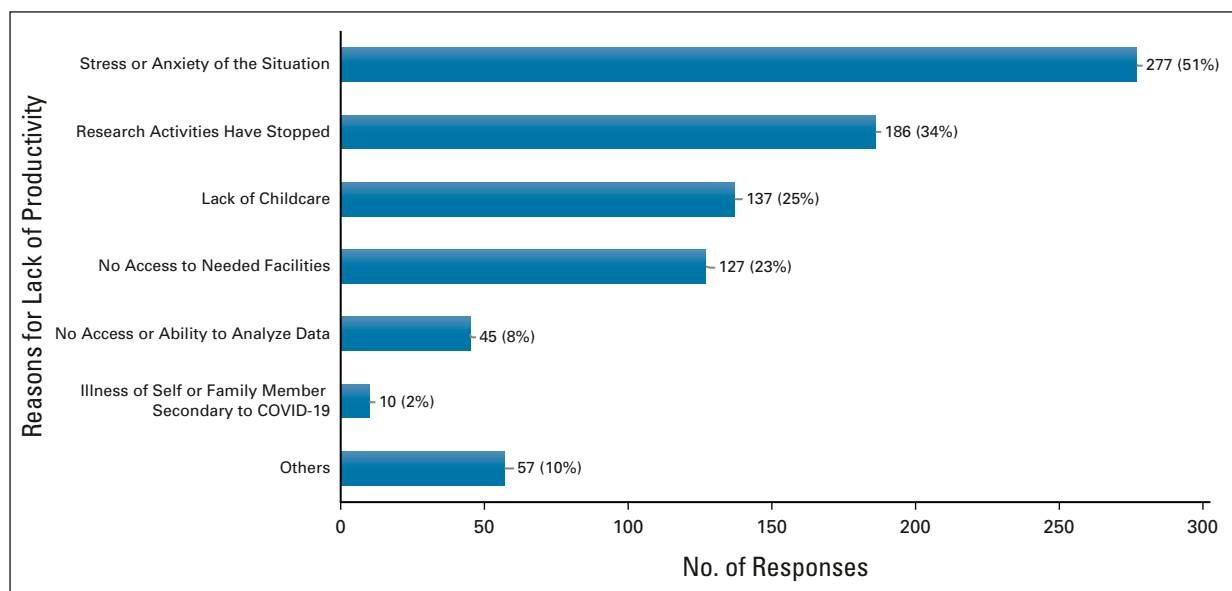


FIG 2. Reasons for reduced productivity during the pandemic. Survey finds COVID-19 pandemic associated with reduced research productivity & burnout in hematology-oncology trainees.

TABLE 2. Univariable and Multivariable Logistic Regression of Variables Associated With Burnout Among Study Participants

Variable	Univariable OR (95% CI)	P	Multivariable OR (95% CI)	P
Pre-existing burnout before COVID-19	10.3 (6.36 to 16.8)	< .001	10.7 (6.38 to 18.2)	< .001
Type of additional COVID-19 work				
No additional COVID-19 work	Reference		Reference	
Clinical COVID-19 work	1.96 (1.29 to 2.98)	.001	2.33 (1.42 to 3.82)	.001
Nonclinical COVID-19 work	1.22 (0.57 to 2.60)	.596	1.59 (0.68 to 3.70)	.279
Clinical and nonclinical COVID-19 work	4.27 (1.00 to 18.2)	.05	3.95 (0.75 to 20.7)	.103
Visa holder	1.03 (0.65 to 1.63)	.883	0.81 (0.46 to 1.41)	.464
Female v male sex (reference)	1.46 (1.01 to 2.11)	.043	1.20 (0.78 to 1.87)	.393
Year of fellowship				
First year	Reference		Reference	
Second year	1.07 (0.68 to 1.67)	.751	0.97 (0.57 to 1.64)	.910
Third year or more	0.55 (0.34 to 0.89)	.016	0.65 (0.36 to 1.16)	.151
Primary work setting				
Adult HO	1.12 (0.69 to 1.81)	.627	1.85 (0.64 to 5.31)	.251
Pediatric HO	1.00 (0.57 to 1.75)	.976	1.85 (0.59 to 5.75)	.286
Research or nonclinical	1.32 (0.76 to 2.30)	.320	2.54 (1.13 to 5.68)	.023

NOTE. Italicized p-values indicate statistical testing met threshold of significance of < 0.05.

Abbreviations: HO, hematology-oncology; OR, odds ratio.

services, including night shifts for up to two to three months, during which time essentially all specialty-related education ceased. Furthermore, fellows reported being excluded from outpatient rotations, with limited opportunities for oncology-specific telemedicine clinics. First-year fellows frequently expressed concerns about missing core learning opportunities, as well as physical and emotional exhaustion because of redeployment.

Didactic lectures and journal clubs were dramatically curtailed and even canceled during the pandemic. Remaining educational activities, such as didactics and board review sessions, were moved to virtual platforms like Zoom. Although virtual meetings maintained some educational continuity during the pandemic, many fellows perceived the overall quality of virtual learning to be low, because of a lack of robust discussions in the virtual environment and technological challenges with navigating online educational resources.

Although tumor boards continued online, fellows often did not have time to participate because of inpatient responsibilities. Moreover, fellows felt that it was difficult to not have cofellows around to talk about cases. The pandemic posed a unique challenge for some third-year fellows, who were not allowed to do pretending weeks where they could develop team leadership skills by acting as an attending physician.

Professional and Career Development Concerns

The pandemic disrupted all activities related to professional development. For some fellows, programmatic budget cuts during the pandemic reduced available funding for ASCO

and ASH memberships, which curtailed access to many resources available through these professional organizations. Many professional meetings and conferences were moved to virtual platforms. Some programs were canceled, including the ASCO Education Scholars Program and some leadership training courses. The majority of fellow respondents indicated that losing in-person conferences curtailed opportunities for professional networking and job interviews, with a deleterious effect on their job prospects after fellowship.

Additional clinical responsibilities significantly reduced board preparation time, and many fellows expressed concerns about whether they would take board examinations during the year at all. Several fellows expressed serious concerns about attaining sufficient clinical competence in specific domains by the end of their training, such as medical oncology, benign and malignant hematology, and bone marrow transplantation.

Research Activity Concerns

Fellows reported severe impacts of the pandemic on research activities. With many laboratories closed and stay-at-home orders issued, research activities across the spectrum were put on hold. Fellows working on wet laboratory and basic science research projects reported complete cessation of many of their research projects. Clinical research projects of some fellows had significantly slowed because of the unpredictability of their mentors' schedules and responsibilities in a changing clinical environment. In addition to these restrictions, increasing clinical duties for fellows in the absence of residents and hospitalists also reduced time for research activities. Fellows expressed concerns about lost

TABLE 3. Broad Themes and Subthemes in the Qualitative Analysis of Open-Ended Responses, Including Representative Quotations and Fellow Recommendations on How Their Concerns Can Be Addressed

Broad Themes	Subthemes	Representative Survey Quotations	Fellow Recommendations
Financial concerns	Additional research training	I was declined support for a master's program because of funding being prioritized for other expenses of the department	ASH could offer CRTI opportunities to more than one applicant from each institution since everything is now web-based
	Faculty positions for graduating fellows	For incoming third-year fellows, we are concerned about the decreased job opportunities with the COVID-19 pandemic as hospitals and practices are struggling financially I hope as we prepare for interview season, they will help us navigate it as a lot of places are not hiring because of the financial burden of COVID-19 As a J1 visa clinical trainee, I have typically had to plan things 6-7 months in advance. At this stage, I should have gotten into the job search and have a sense of my postfellowship transition. With most academic programs on a hiring freeze and research projects suspended, I feel I am in a purgatory state; I am doubtful I will complete my research projects in time for graduation but I need them to get the job I want	Provide trainees insight into how to time their job search, given many hospitals are on a hiring freeze with no bonus salaries and no retirement benefits ASH and ASCO should be more proactive in ensuring J1 trainees are well insulated from excessive uncertainties regarding fellowship completion, career development, and immigration hustle Lobby for specific programs to extend the J1 grace period for those graduating in June 2020 and June 2021 to ensure trainees have adequate time to complete their plans during training Advocate for trainees who are not legal permanent residents, because the government bodies, particularly USCIS, are not considering any special relief for temporary workers (J-1, H1B, O-1, etc)
Educational concerns	Removal from core or elective educational opportunities	I was pulled from elective weeks where I otherwise would have been working in disease-specific clinics and learning more about chemotherapy. I was initially pulled off of rotations required for graduation to work COVID-19 oncology inpatient; however, this is now being accommodated for and/or I will have to make these up in my last year of fellowship My entire BMT [bone marrow transplant] rotation was taken over by COVID-19; thus, I will not get that opportunity any longer unless I take time out of my elective portion of fellowship to seek out that opportunity The redeployment of fellows to function as interns and residents on the hematology and oncology inpatient services, the widespread use of e-consults, and the removal of fellows from ambulatory clinics have disrupted the clinical educational program	Improve online lectures and provide core didactics for free during the pandemic Provide fellows with updated guidelines and educational resources for non-COVID-19-related topics that they will be required to know before finishing fellowship Advise program directors on how to apply time spent redeployed toward fellowship requirements Provide all ASCO and ASH meeting recordings for free for fellows
	Undue clinical burden on first-year fellows	The first-years who were already meant to be inpatient have been taking the brunt of the work now redeployed as interns or residents again taking care of both oncology and nononcology patients with COVID-19, whereas the upper-level fellows have had much more time off without the usual electives or clinic rotations happening because of the pandemic. This has led to the first-years being much more exhausted physically and emotionally while many other fellows are sitting at home relaxing and having time to study and conduct research	Issue statements to ensure that faculty protect the learning environment for fellows and to not use trainees for hospitalist work taking care of patients with COVID-19 unless absolutely necessary for the medical system
	Limited opportunities for didactics	Board preparation lectures have disappeared entirely. All educational activities (lecture curriculum, conferences, etc) have been canceled for the past month and a half. Education and professional development has taken a substantial hit during this time A lot of our fellowship lectures were canceled, so our learning has been limited	Ensure the ASH and ASCO national conferences can be viewed virtually Provide additional guidance on the management of COVID-19-related hematologic disorders
	Limitations of virtual learning	All didactics have moved to Zoom, which is fine but not ideal as it is harder to facilitate discussion on this platform Everything has to go through a remote interface, which is finicky to use. Everything is taking longer to get done while working remotely	
Lack of educational collaboration with colleagues	It is also hard to not have your cofellows around to just talk about cases Although tumor boards continue, fellows often do not have time to participate because of inpatient responsibilities		
Inability to develop autonomous clinical skills	I am no longer allowed to do marrows or LPs because of trainee restrictions. We are also not allowed to do a 'pretending' week where the 3rd-years spend a week acting as attending	Advocate for fellows' autonomy to practice at or above their level of training, rather than participate in less clinically demanding work	

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TABLE 3. Broad Themes and Subthemes in the Qualitative Analysis of Open-Ended Responses, Including Representative Quotations and Fellow Recommendations on How Their Concerns Can Be Addressed (continued)

Broad Themes	Subthemes	Representative Survey Quotations	Fellow Recommendations
Professional and career development concerns	Canceled career development opportunities through national organizations	Importantly, because of cancellation of professional conferences (AACR and ASCO), I have missed key networking opportunities that I was counting on in anticipation of applying for jobs next year	Provide virtual mentorship opportunities, including connecting current trainees with academic and private practice hematologists Develop a centralized job posting portal, which includes academic, private practice, and other hematology careers Provide information about which organizations are hiring during the pandemic Host a virtual job fair
	Board examinations	We for the most part resumed conferences via Zoom but there is less personal time to prepare for boards or read for professional development I worry that I will not be able to take my board examinations this year	ASH and ASCO should develop better phone-based applications for board review questions
	Inadequate transition into career independence	I am fearful of being competent to enter into independent practice. Options for fellowships are on hold. Teaching is nil. I am worried I will not be able to manage patients on my own	Encourage telemedicine as a continued viable option for clinical practice ASCO and ASH should offer virtual training opportunities so that fellows can develop different skill sets
Research activity concerns	Lack of access to patients for research	The biggest impact has been on my translational research that requires fresh patient samples. Because research activities have been minimized and patients are not coming in as regularly, this has brought my research efforts to a standstill I was previously doing face-to-face survey research with plans for focus groups but I am unable to do those because of COVID-19 Protocols are being suspended including a protocol I had planned to launch this summer	
	Lack of access to laboratory facilities	I do not have access to the physical laboratory, the research cores I depend on are shut down [...] It has been a disaster professionally My laboratory was shut down, limiting my ability to complete my research before concluding my training Not having access to laboratory equipment to do experiments severely limits my research abilities at home There has been a very negative impact on the fellows doing laboratory research, since they have been completely shut down	Strengthen virtual mentee-mentor programs and engage research fellows in particular, as they are often neglected compared with clinical fellows ASCO and ASH should introduce more research grants particularly for nonclinical researchers, because laboratory researchers and postdoctoral fellows are the most vulnerable during the current research climate
	Lack of time for research because of COVID-19-related clinical responsibilities	Six- to eight-week deployments of all fellows to either inpatient COVID-19 units or as frontline providers for inpatient hematology-oncology patients was difficult because of the time away from research for 2nd and 3rd year fellows I am actually a research fellow who needs to see more patients these days to take care of cancer hospital patients who were used to be taken care of by the medicine residents and hospitalists Working more hours in a challenging environment with multiple and frequent changes in policies has limited time that would have been spent in research opportunities	
	Concerns about grant funding	My preliminary data acquisition and research experiments are on hold and that greatly affects my applications for future grants	Extend deadlines and funding opportunities for fellows in the transition period Lower requirements for providing preliminary data for grant applications Develop a COVID-19 research supplement for trainees who were funded by ASCO or ASH during the pandemic Develop an endowment for junior investigators to continue the pipeline of physician scientists

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TABLE 3. Broad Themes and Subthemes in the Qualitative Analysis of Open-Ended Responses, Including Representative Quotations and Fellow Recommendations on How Their Concerns Can Be Addressed (continued)

Broad Themes	Subthemes	Representative Survey Quotations	Fellow Recommendations
Overall productivity concerns	Increased productivity because of less distractions	Currently, I am reading and writing papers most of my time. Since there is no disturbance by anyone, I feel I am more productive than usual in terms of reading and writing	
	Decreased productivity because of domestic and childcare responsibilities	I have two young children who are home from school and have no other homeschool or childcare help except for my wife who is also trying to 'work' full time. My mentors all have much older kids and have not been locked out of their offices and are pressuring me to finish projects at the usual speed Certainly less productive from a clinical standpoint. My research work may be somewhat more as I have more free time, but that is also balanced by greater childcare responsibilities, so I believe the net productivity is lower I have my kids with me all the time because of shelter-in-place and all-day care is closed (except when I am in clinic or the hospital). Then, care falls on my partner (and my partner needs to then make up that time with their full-time job); it is exhausting and I end up working late and waking up early to maintain productivity In nonclinic days, we are encouraged to work from home. I have been faced with accepting poor productivity in a busy home household or risking going to my office and exposure to try to maintain my work	Provide safe childcare facilities
	Decreased productivity because of the pandemic atmosphere itself	I am less motivated after spending the day in full PPE on COVID-19 floors with deteriorating patients I also spend a lot of time procrastinating, since there is no real work time vhome time, as all of my work is now done at home The stress of being in the hospital has made me less productive once I leave work. Previously, I had been able to continue projects while at home, but now I use the time at home to focus on destressing	
Mental health concerns and stress responses	Stress regarding personal safety and the health of family	Baseline stress level is much higher because of the uncertainty of the pandemic. I am unable to perform my usual 'self-care' by spending time at the gym as all the gyms are closed. I am also not sleeping well because of general concerns (from professional to personal—will my parents be okay?) about the future secondary to the pandemic	Provide guidance on how fellows can protect the safety of themselves and their patients as they transition to a world with less social distancing
	Constant changes	Stress and constant changes in schedules, protocols, and procedures because of COVID-19 have made it difficult Multiple changes and additional steps with reduced staff making any task longer and more complicated	
	Information overload	There is more information overload re: COVID-19 (e-mails, townhall meetings, GME meetings etc), unfamiliarity with new workflow in a quickly evolving environment. There is also added stress from uncertainties with the pandemic	Create mental health resources for fellows going through unprecedented and stressful times in their careers
	Lack of camaraderie	More mentally straining, with no random conversations with colleagues that help break up the day and it is harder to stop working in the evening, leading to working longer hours	Share humanistic and uplifting stories to rejuvenate resilience among fellows
	Improving resilience during the pandemic	I think the stress and anxiety early in the pandemic made it difficult to focus. Now that we have started to reach a new normalcy, productivity has improved	

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TABLE 3. Broad Themes and Subthemes in the Qualitative Analysis of Open-Ended Responses, Including Representative Quotations and Fellow Recommendations on How Their Concerns Can Be Addressed (continued)

Broad Themes	Subthemes	Representative Survey Quotations	Fellow Recommendations
Institutional and programmatic support concerns	Emotional support	My fellowship program has been very supportive through this time, especially my program director. He has acknowledged the stress of times and has been providing emotional support to us. It would be nice to get the same appreciation from the rest of the faculty	
	Reduction of COVID-19 exposure at work	They have tried to protect us from exposure to patients with COVID-19 and working mostly with e-consults and televisits My fellowship program has already been extremely supportive. Because I am pregnant, they voluntarily and preemptively helped me to avoid inpatient duties to reduce my risk and exposure A dedicated source of PPE for fellows only would help to alleviate some of the stress of finding our own PPE at each site we are deployed to for our rotations	
	Concerns about program transparency	I feel that we could get a better sense of the difficulties program leadership and our mentors are facing. It would help put things into perspective so that instead of feeling abandoned from a research standpoint or complaining that rotations have changed, we understand that the higher-ups have much more important and stressful things on their plate such as job security, funding, pay cuts, restructuring of clinical practice, etc	Advocate for hazard pay, job security, and job safety for trainees Guide program directors to safely navigate issues related to trainee safety, including prevention of trainee abuse because of workload

Abbreviations: ASH, American Society of Hematology; CRTI, Clinical Research Training Institute; GME, graduate medical education; PPE, personal protective equipment; USCIS, United States Citizenship and Immigration Services.

research time affecting grant opportunities as well as job applications in the future.

Overall Productivity Concerns

Fellows reported both positive and negative dimensions in regard to the question of how the pandemic affected productivity. With the majority of fellows working from home whenever they did not have clinical duties, some fellows discussed using virtual learning opportunities and working from home to catch up with the literature and complete writing projects. These fellows reported that working from home was more productive than in-person interactions in the office owing to additional flexibility, time saved from not commuting to work, and the ability to complete more tasks.

However, many fellows expressed concerns over their declining productivity during the pandemic. Major hurdles for productivity included increased responsibilities for domestic care and childcare, reduced hours at work, and distractions in the home environment that affected both the quality and quantity of their work. Male and female fellows had similar responses to this question (data not shown). In addition to domestic responsibilities, fellows reported that the overall pandemic atmosphere influenced their emotional and motivational levels at work.

Mental Health Concerns and Stress Responses

The drastic changes in the learning environment and clinical redeployment, as well as ongoing changes in schedules because of COVID-19, made the work and life of fellows more difficult and stressful during the pandemic. As many fellows reported, the fear of unknown outcomes in COVID-19–positive patients, and serious concerns about the health of fellows and their families, generated considerable distress. In addition to concerns about safety and wellness, fellows also lamented information overload related to COVID-19, including numerous e-mails, townhall meetings, and GME meetings. These stressors, as well as uncertainty regarding continual changes in workflow, also influenced fellows' mental health. However, some reported improved resilience amid stressful conditions as the pandemic progressed.

Institutional and Programmatic Support Concerns

Most fellows reported that their programs were helping them to navigate clinical and educational activities during the pandemic, including virtual educational and professional development activities. Fellows reported that program directors regularly asked them about their physical and mental health. Overall, fellows reported that their programs attempted to maintain normalcy through regular virtual meetings to provide updated information about institutional policies, COVID-19–related procedures, and fellows' roles and expectations. However, transparency within fellowship programs was not ubiquitous. Several fellows raised serious concerns about their safety and well-being during the pandemic. They wanted to ensure

adequate access to PPE, which had been a significant concern in some regions during major COVID-19 surges. Some programs did provide a hazard allowance for fellows.

DISCUSSION

These data demonstrate that most HO trainees had significant concerns about career planning, research funding, productivity, educational quality, and ability to finish training because of the COVID-19 pandemic. In one of the largest studies of postgraduate trainees in the United States, we identified potential avenues for individual institutions and national organizations to better support HO trainees.

Worsening mental health was a significant concern among survey respondents, with 22% of trainees without burnout symptoms before COVID-19 reporting new symptoms of burnout since the beginning of the pandemic. COVID-19–related work, whether clinical or nonclinical, was a significant predictor of burnout in the univariate analysis, as well as pre-existing burnout, female sex, and first-year of fellowship. These findings mirror results in studies of other types of trainees, including a survey of Saudi ophthalmology trainees in which only 6% of respondents reported no effect from COVID-19 on their mental health¹⁸ and another study of Pakistani residents, which found that two thirds reported complete psychologic abandonment within their departments.¹⁹ Frontline trainees have previously reported worse burnout and stress during the pandemic compared with nonfrontline trainees,^{12,20} with our study additionally finding that nonclinical COVID-19 work may also contribute to trainee burnout. Multivariable analysis of burnout risk factors found a strong association of pre-existing burnout (OR, 10.7) with development of burnout, as well as clinical COVID-19 work and research or nonclinical primary work setting. Pre-existing mental illness is a known risk factor for worse mental health in health care workers during the COVID-19 pandemic.^{21,22} However, the observation that nonclinical fellows are at risk for burnout is an important finding, as the COVID-19 literature has demonstrated mixed findings with respect to mental health among medical versus nonmedical health care workers.¹² Several studies of women trainees and physicians have demonstrated increased risk of work-related burnout^{23,24}; factors such as workplace bias or harassment and home or childcare responsibilities may contribute. Previous studies examining mental health during the COVID-19 pandemic have demonstrated that physician trainees are at least similarly²⁵ if not more affected²⁶ by the pandemic in several domains of mental health. In HO, first-year fellows may also be more susceptible to burnout at baseline because many fellowships are structured to make the first year the most clinically intense year, thus placing first-year fellows on the frontlines of COVID-19 care. As seen in the qualitative analysis in [Table 3](#), fellows described the relatively higher workload on first-year fellows compared with senior fellows who were able to do research at home.

Our survey revealed concerns about the quality of trainee education during the pandemic, with the transition to virtual learning being met with mixed responses. Some studies have found positive responses to virtual learning among trainees, including a survey of first-year HO fellows at Dana Farber Cancer Institute, which found higher attendance rates and more interactive sessions with virtual conferences compared with in-person lectures.²⁷ Similarly, the majority of HO fellows at MD Anderson felt that an online-based lecture program was as effective as in-person learning and considerably more flexible.²⁸ However, not all training programs were able to transition seamlessly to virtual learning. As summarized in [Table 3](#), many fellows described complete cancellation of didactic and board preparation lectures for some portion of the pandemic, as well as inherent limitations in learning on a virtual platform because of technical challenges and lack of interaction among cofellows.

It is well known from studying health care workers during the SARS epidemic of 2003 that clear, supportive, and consistent communication from leadership contributes to both organizational resilience as well as improved mental health.^{29,30} These initiatives suggest that proactively addressing the well-being of trainees is a vital component of a successful trainee program response to the pandemic. It is important to note that 14% of fellows reported inadequate access to PPE, as lack of access to adequate PPE has been associated with worsening mental health in several studies in the COVID-19 era.¹² Institutions have reported on efforts to improve the experience of HO fellows during the pandemic.²⁷ Because of the surge in Boston, Dana Farber fellows were pulled from various outpatient rotations to cover COVID-19–related services. However, fellows were rotated 4 days on and at least 4 days off to distribute the work more evenly, and COVID-19–related updates were given to fellows on a weekly basis, which was well received among first-year fellows. Additionally, the fellowship converted all didactics to interactive biweekly virtual teaching sessions to compensate for lost time in outpatient clinics. In other postgraduate settings, switching to an online curriculum was met with positive feedback when accompanied with emphasis on peer support and the provision of confidential therapist sessions for trainees.³¹ Other trainee recommendations from our survey, such as advocacy for practical supports including childcare and hazard pay, have also been demonstrated to be helpful for the well-being of health care workers.^{12,32}

Although virtual didactics have received mixed feedback, trainees have reported that clinical training significantly suffered across specialties. Survey respondents described being removed from core and elective rotations during the height of the pandemic, risking not being able to complete required rotations for graduation as well as not completing rotations needed for autonomous and independent practice after graduating. During the initial COVID-19 surge,

many fellows were required to cover COVID-19 inpatient services. Redeployment to COVID-19–related work may have had an impact on hematology-oncology trainee formation; 18% of survey participants reported considering changing their career plans because of the pandemic, and a majority were concerned about the quality of their education and clinical training. This concern was similarly highlighted in a study of neurology trainees in Italy; 34% of respondents believed COVID-19 had or would have a positive impact on their formation as general clinicians, but almost 70% believed it either had or will have a negative impact on their formation as neurologists.³³ Published analyses of surgical and procedural specialties have noted dramatic decrease in elective procedures and opportunities for hands-on training.^{20,34} Although HO is not a procedurally heavy specialty, follow-up analyses assessing the impact of COVID-19 pandemic on graduating HO fellows' level of comfort with procedures such as bone marrow biopsy and lumbar puncture are necessary.

The impact of COVID-19 on HO trainee research activities varied on the basis of the type of research work being performed. Lack of patient access for clinical research and inability to access laboratory facilities for bench research were major barriers ([Table 3](#)), with significant challenges for laboratory-based fellows who expressed concerns about inadequate qualification for grant funding because of lack of research productivity. Similar concerns about trainee research productivity were reported for allergy and immunology trainees in United States and Canada, in which 38% were concerned about finishing their research before the end of fellowship.³⁵ With reductions in grant opportunities, there were numerous requests by fellows for ASCO and ASH to intervene to create more flexible submission requirements and deadlines ([Table 3](#)). Similar requests to expand funding opportunities, increase K-award pay-lines, and extend award durations have been published by trainees in other specialties.³⁶ Given HO fellow concerns about transition to independence in the post-COVID-19 era, implementation of such initiatives may benefit trainees in HO.

Job availability was a major concern for fellows because of lack of in-person job networking opportunities at national conferences, hiring freezes limiting faculty positions for graduating fellows, and concerns about visa requirements. Most fellows were concerned about obtaining a job offer after the pandemic, which is of particular concern, given that 76% of survey respondents were concerned about finishing training on time. Lack of in-person networking opportunities seemed to be a major concern as well, suggesting the important role these opportunities may play for meeting mentors and obtaining a post-training job.

There are several limitations to our survey-based study. First, our survey response rate was only 24%; although this response rate is lower than that of other surveys of trainees during the COVID-19 pandemic, this was also the first nationwide trainee survey addressing the impact of COVID-

19, whereas other studies were focused on specific geographic areas or institutions, which may have been easier to survey. Additionally, since we did not collect data on demographics such as race, ethnicity, or program location, there may be subsets of trainees that are more vulnerable to the negative impact of COVID-19, which were not captured by our analysis. Furthermore, as the survey was distributed electronically through ASCO and ASH, fellows who are not members of these organizations are not represented in this analysis. Given that survey collection concluded in August 2020 and this study was cross-sectional in nature, the analysis does not capture changes in the training experience with subsequent waves of the pandemic. Finally, we used a 1-item measure to assess burnout in our population. Although this tool has been validated in health care personnel, it is limited in its ability to fully assess the breadth and depth of burnout in this population when compared

with more thorough tools such as the Maslach Burnout Inventory.¹⁶

In conclusion, our quantitative and qualitative analysis of a large cohort of HO trainees enabled the description of the major concerns from the initial months of the COVID-19 pandemic, including trainee-generated recommendations for fellowship programs and national organizations to better address trainee needs. HO fellows were significantly affected by COVID-19 in all aspects of training and career development, and there were deleterious effects on the mental health of trainees with identification of several at-risk subgroups. Although we do not yet know the long-term effects that this pandemic will have on the future of HO education, this study provides a critical foundation to develop programs as well as policy interventions to improve the trainee experience as the pandemic progresses.

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AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

Impact of COVID-19 on Hematology-Oncology Trainees: A Quantitative and Qualitative Assessment

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