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Dealing with the extraordinary: how a community of practice supports resident training during the COVID-19 pandemic and beyond



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Abstract

Background The practice of medicine occurs within a community of practice (CoP), where learning is shaped through shared purpose, the interaction of members, and the development of collective knowledge and skills. Through experiential learning, medical trainees become healthcare professionals within this community. The COVID-19 pandemic disrupted traditional training models, requiring residents to adapt under extraordinary circumstances. This study applies a CoP lens to explore how residency program directors (PD) perceived residents' learning, competence development, and adaptation during the pandemic.

Methods A qualitative analysis was conducted on PD's written responses to a COVID-19 survey administered by the Accreditation Council for Graduate Medical Education-International from July 1 to September 30, 2020. De-identified narrative reflections on the pandemic's impact on clinical learning environments and training experiences were analyzed using thematic content analysis.

Results Responses from 138 PDs in six countries were analyzed. Three themes emerged, highlighting the social and dynamic nature of experiential learning in a CoP: (1) capability building, where residents adapted by integrating and applying knowledge, skills, and attitudes as modeled by faculty and peers; (2) fostering resilience in the face of uncertainty through altruism, volunteerism, strong support networks, and collective moral resilience; and (3) collaborative working and communicating across interdisciplinary and interprofessional teams, facilitated by a flattening of traditional hierarchies.

Conclusions Support from senior physicians and a shared sense of purpose facilitated residents' learning in a rapidly changing, high stakes environment. This accelerated experiential learning occurred through engagement within a CoP. Our findings illustrate how the CoP framework can help residency programs foster adaptive learning and resilience during future large-scale disruptions to medical training.

Keywords Residents training, Experiential learning, Community of practice, COVID-19, Pandemic, Education disruption

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Background

Transformative events lead to major shifts in seeing, thinking, and doing. The COVID-19 pandemic was a transformative event that disrupted graduate medical education (GME) globally. Research has explored the pandemic's effects on clinical experiences [1, 2], resident and faculty well-being [3], and the future pipeline of physicians [4]. Many studies describe the rapid adoption of virtual learning [5-7], telemedicine [8, 9], and simulation [10]. Other reports focus on the disruption of clinical teaching [11] and subsequent trends in postresidency career choices [12, 13]. While current literature provides a broad description of the impact of COVID-19 on GME, few studies have examined how GME adapted in real-time and what lessons can be applied to future crises. Moreover, most research focuses on North American and European training environments, with limited insights from international GME programs, particularly those in the Middle East and Asia, which often have distinct cultural, regulatory and economic constraints [14]. Understanding how these programs navigated the crisis is essential for developing adaptive and resilient training programs globally.

The pandemic represents a large-scale disruption that created unique circumstances for GME. Clinicians, educators, and trainees had to navigate an unknown, constantly evolving situation without expert guidance. Healthcare professionals, regardless of seniority or level of training, dealt with an overwhelming workload, as well as fear and uncertainty about the disease and its management, while also processing a rapidly increasing volume of information and mis/disinformation. These conditions challenged accepted GME models of on-the-job or situated, experiential learning and called for new models of training. The importance of this issue is underscored by the potential for future large-scale disruptions - whether due to emerging infectious diseases, geopolitical crises, or extreme weather events - which could similarly challenge traditional GME structures.

One lens to view how learning occurred during the pandemic is the Community of Practice (CoP) model. First described by Wenger in 1998 [15], this framework refers to "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" [16]. There are three main characteristics of a CoP: (1) the group shares an identity based on a common interest, members are committed to this common interest, and expertise related to this common interest is valued; (2) members are practitioners who engage with each other by sharing information and assisting each other around this common interest; and (3) members learn from one another with each member actively contributing to the group's learning. Applying this model allows analysis of how learning shifted from the individual to the community during the pandemic [17], highlighting both strengths and gaps in program responsiveness.

In this manuscript, we use the CoP model as the overarching framework to examine the perspectives of program directors (PD) in international GME programs on resident experiences, competence, and learning during the COVID-19 pandemic. By identifying key lessons learned, we aim to provide a roadmap for how GME can better prepare for and respond to future large-scale disruptions.

Methods

A qualitative approach using content analysis was conducted on open-ended survey responses of PD reflections on resident experiences and competencies during the COVID-19 pandemic. The investigators analyzed the data and developed meaningful conclusions to answer research questions using inductive reasoning [18]. Our methodological approach fits well with our constructivist research paradigm, which emphasizes multiple, varied perspectives and the importance of investigator interpretations [19].

Setting and participants

The Accreditation Council for Graduate Medical Education-International (ACGME-I), a nongovernmental organization formed in 2009, oversees the accreditation of GME programs outside the United States [20]. At the time of the study, 161 residency and fellowship programs in six countries in Asia and the Middle East were accredited by the ACGME-I and are included in the study. The term "resident" is used to describe both residents and fellows throughout.

Data collection

In 2020, the ACGME-I incorporated a supplementary survey into its required annual data update from training programs worldwide. The survey questions were developed through an iterative process by a panel of medical education specialists with expertise in GME and survey design. To establish content validity, the survey items were reviewed by a survey development expert, ensuring alignment with best practices in survey methodology.

The final question prompting reflections on resident competency was designed as an open-ended item to elicit narrative responses without leading or restricting participant perspectives. PDs were asked to consider the COVID-19 pandemic as an "ideal opportunity to reflect on residents' competency in dealing with extraordinary clinical circumstances" and describe "what the pandemic taught you about resident competency" in the areas of patient care, medical knowledge, health disparities, or communication, teamwork, and professionalism. To enhance response reliability, the survey was administered via the ACGME-I's Accreditation Data System – a secure online platform routinely used for annual data collection, ensuring familiarity among PDs. Each PD received a unique survey link via email, directing them to the secure platform to submit responses. PDs were informed that responses were not identifiable by program or institution and would not be used for accreditation decisions. This approach was intended to mitigate response bias. Additionally, the use of a standardized administration process and a consistent data collection timeframe (July 1- September 30, 2020) ensured uniformity in data gathering. Automated email reminders were sent to non-responders throughout the survey period to improve response rates.

Data analysis

After reading and familiarising ourselves with the survey responses, we adopted an inductive approach to explore the data. Through this process, we recognized that the CoP model provided a meaningful framework to interpret the findings, as many programs demonstrated CoP elements, even if not explicitly described.

De-identified responses were analyzed using thematic content analysis, guided by the CoP model as a conceptual framework (Fig. 1) [21, 22]. This approach allowed us to identify recurring themes in PD reflections on resident learning and training experiences during the COVID-19 pandemic. Two members of the author team with qualitative research training (JO and SA) independently coded the data, with participation and guidance from a third author (HI), who is also a trained qualitative researcher. The analysis followed an inductive, iterative process, where responses were first reviewed for recurring concepts. Initial codes were developed directly from the data. These codes were then grouped into broader themes aligned with key components of the CoP framework, such as shared identity, collaborative learning, and community engagement. The final coding template, revised and adapted based on insights from subsequent analysis, was applied to the full data set. Each step was followed by team discussions where consensus was reached [18]. This iterative process of coding, discussion, and comparison was continued until no new themes were identified, indicating that thematic sufficiency was reached. The themes generated were sent to select PDs for feedback to enhance data credibility [23]. The analysis was conducted using ATLAS.ti Mac Version 23.2.1 qualitative data analysis software (ATLAS.ti Scientific Software Development GmbH; Berlin, Germany).

Team reflexivity

Our research team includes a senior director of ACGME-I and three current (JO) or former (HI and SA) PDs in countries included in the survey. The investigators ensured that the analysis was not systemically distorted by their assumptions and preconceptions through consistent quality and reflexivity checking [24]. JO and SA kept a reflexivity diary to reflect on the process as well as their influence and role in the study.

Ethical approval

Ethics approval was obtained from the National University of Singapore Institutional Review Board (NUS IRB Reference No. 2020/01412) with a waiver for informed consent as data was de-identified and retrospective.

Results

161 programs from 6 countries responded to the survey (Table 1). PDs of 138 programs (86%) replied with an open-ended narrative and were included in the analysis. There were no significant differences between responders and non-responders in terms of program type, residency/ fellowship status or geographic location. Three major



Program type	Residencies	Fellowships	Country						
			Lebanon	Oman	Qatar	Saudi Arabia	Singapore	United Arab Emirates	
Hospital-based ^a	31	1	4	4	5	0	12	7	
Surgical-based ^b	42	1	8	5	8	1	14	7	
Medicine-based ^c	34	52	6	5	20	0	33	22	
TOTAL	107	54	18	14	33	1	59	36	

Table 1 Participating program characteristics

^aHospital-based programs include: Anesthesiology, Emergency Medicine, Pathology, Pediatric Radiology, Radiology, Radiation Oncology and Transitional Year; ^bSurgical-based programs include: General Surgery, Neurological Surgery, Obstetrics/Gynecology, Ophthalmology, Orthopaedic Surgery, Otolaryngology, Pediatric Surgery, Plastic Surgery and Urology; ^cMedicine-based programs include: Allergy and Immunology, Cardiovascular Disease, Child Neurology, Child Psychiatry, Dermatology, Endocrinology, Family Medicine, Gastroenterology, Geriatric Medicine, Hematology, Infectious Disease, Internal Medicine, Neonatal/Perinatal Medicine, Neurology, Nephrology, Medical Oncology, Pulmonary Disease, Rheumatology, Pediatrics, Pediatric Cardiology, Pediatric Gastroenterology, Pediatric Nephrology, Pediatric Pulmonology, and Psychiatry

themes were identified: capability building, fostering resilience, and collaborative working (Fig. 1). Each theme is discussed below, with excerpts from the PD narratives to evidence our findings.

Capability building

Regardless of country, institution, or specialty, PDs agreed that the trainees demonstrated the ability to integrate and apply their acquired knowledge and skills to adapt to the rapidly changing and complex situation. Building this capability included embracing uncertainty in a meaningful way through rapid upskilling as new information and treatment strategies emerged and engaging virtual platforms to continue medical training and patient care. The residents remained updated on new information through multiple sources. They relied on protocols with step-by-step clinical guidance to deal with the treatment uncertainties of COVID-19 as well as gain reassurance from their institutional CoP that they were providing the correct management.

"The protocols that were evolving frequently were assimilated by the residents very well and implemented accordingly. Residents kept themselves updated on medical knowledge of the pandemic by reading and attending local and international webinars on COVID." PD 1.

"Residents demonstrate rapid learning and growth during the pandemic by regular review of publications and data on various aspects of COVID [...] strive to become increasingly independent and manage their patients independently (with appropriate supervision) in addition to peer learning by discussing cases with other residents or during "multidisciplinary team grand rounds" including the infectious disease team." PD 2.

As routine hospital practices were abandoned to deal with the increasing volume of COVID-19 cases, residents from different training programs were often deployed to unfamiliar working environments to aid in the pandemic response. Residents from medical disciplines stepped up to help guide and upskill junior residents and peers from surgical disciplines. The trainees adapted and learned through role-modeling, support, and close supervision of cross-discipline peers and faculty within their CoP.

"The senior residents helped out with upskilling interns, family medicine residents, and GPs to work in COVID isolation facilities." PD 3.

"The pandemic provided an opportunity for programs and learners to realize the dynamic nature of medical knowledge is essential for physicians to respond to a novel threat to human health. Trainees were immersed in institutional learning experiences, demonstrating the commitment that physicians make to lifelong learning. Frontline clinicians demonstrated how physicians with diverse skill sets and different disciplinary lenses come together to solve complex healthcare problems." PD 10.

The residents also developed effective learning and training strategies to overcome the social distancing rules, such as online education rounds (e.g. journal clubs and morning reports). Virtual platforms provided an alternative option for information sharing and learning through engagement with multidisciplinary professionals across departments, institutions, and even international faculty and peers.

"We learned new ways of improving medical knowledge by having virtual meetings for the weekly didactic activities like clinical case discussions. Our faculty supervised such sessions even from other countries, which was a good experience, and removed barriers to help faculty to attend educational conferences." PD 4.

Fostering resilience

The pandemic caused increased anxiety, stress, and psychological distress in the trainees, especially for those who were at the front line of patient care. Most residents recognized when they were adversely affected by stress, especially when working outside their comfort zones. They actively sought and provided support and guidance from peers experiencing similar work-related stressors. Senior internal medicine residents willingly stepped up to support their juniors and trainees from other disciplines by providing clinical support, including the dissemination of up-to-date information or coverage of the residents' duties when needed, and psychological support, such as identifying and reporting concerns with fatigue and burnout.

"As it is a new pandemic, there are inevitably many stressors that surfaced. We have observed that the residents have stepped up to the challenge to support their peers. The residents have shown resilience during the pandemic through a strong peer support network." PD 5.

Through regular meetings and interactions, the PDs and faculty also made efforts to reach out and connect with the residents to provide clinical guidance and psychological support.

"Due to major safety concerns of residents, the program has been in contact with residents on a regular basis. Residents were encouraged to report any concerns, safety issues, fatigue, or burnout during these special times." PD 6.

"The residents were under pressure as the rest of the staff, but it was a good learning experience for them to work in extraordinary circumstances." PD 18.

Although the desire to help was sometimes outweighed by the day-to-day demands of the increasing workload and uncertainty of the evolving pandemic, the residents saw working during the pandemic as their *calling* and embraced the opportunity to be involved by taking on more responsibilities and duties to help relieve the pressures on their fellow residents.

"I know the residents better as I clearly saw altruism among the majority...some asking to volunteer in the front line, others working long hours to help their teams. Many were also doing teleconsultation...following their patients until they get to the point of care, showing empathy and commitment." PD 7.

Collaborative working

During the pandemic, the clinical situation evolved daily with the rapid emergence of new information, changing care processes and workflows in every department, hospital, and healthcare system. As such, the residents learned to work and communicate well in multidisciplinary and interprofessional teams. Collaborative working and timely communication were important in Page 5 of 9

managing the crisis requiring the expertise, knowledge, and skills of both medical and non-medical health professionals. They learned to share experiences and information to help improve work conditions and ensure optimal patient care for both COVID and non-COVID patients.

"The residents were immersed in institutional learning experiences, where clinicians demonstrated how physicians with diverse skill sets and different disciplinary lenses come together to solve complex healthcare problems." PD 8.

"The residents are conscientious in ensuring correct and up-to-date information and SOPs [standard operating procedures] are adhered to and communicated among all medical staff and AHPs [academic health professionals], working together closely in a true multidisciplinary fashion." PD 12.

The PDs acknowledged that the willingness of faculty to work alongside residents as a team, regardless of the level of seniority, provided the residents with much-needed motivation and role-modelling opportunities. Dealing with a novel virus placed everyone at the same level of knowledge and experience. This flattening of hierarchy helped the residents learn that it was acceptable for physicians not to know everything in medicine but rather to keep updated through sharing information and learning from each other. The exposed vulnerability and humility from these shared experiences heightened their sense of belonging within the medical community.

"The ambiguity of the new disease and unknown impact on patients put both the residents and faculty at the same level of knowledge and certainty. Senior medicine residents were leading and supervising non-internal medicine physicians (e.g. consultant surgeons), yet were able to work effectively in a multidisciplinary team." PD 11.

"Although residents found it challenging to "supervise" or assign tasks to more professionally "senior" colleagues, they showed professionalism in working alongside their colleagues." PD 17.

"Given the dynamic situation, our fellows were more partners in changing our care and educational environment." PD 19.

Lastly, the residents identified that effective and frequent communication with patients and their families was crucial despite the challenges of social distancing, which limited direct contact. For patients admitted to the hospital, regular updates to families were made via phone calls. For patients in ambulatory care, physical clinic visits were switched to teleconsultations. "Residents rapidly developed the skills to conduct teleconsultations and kept in touch with our patients, especially the very complex patients with the need for regular follow-up to avoid complications." PD 15.

"Residents used telemedicine and other means to communicate with patients and their families to answer questions and follow-ups." PD 16.

Discussion

Using CoP as the theoretical framework, the results from this study identified three dominant themes regarding how residents' training experiences during the COVID-19 pandemic can inform GME in managing future largescale disruptions. The first theme relates to how a CoP provides learners with the means to navigate uncertainty. While the practice of medicine is always fraught with uncertainties, the pandemic brought a heightened level of complexity and unpredictability. Despite the lack of knowledge about this novel disease, residents managed the unfamiliar situation, demonstrating adaptability to make sense of constant changes and inform their practice [25, 26]. They engaged in self-directed learning by identifying and bridging relevant clinical gaps [27]. These authentic experiences during critical years of training formed the foundation of experiential learning during the pandemic, integrated within a CoP. These findings can help residency programs move beyond the welldescribed adoption of tools such as virtual learning [5– 7], telemedicine [8, 9] and simulation [10]. It is through shared experiences and mentorship that residents developed strategies to navigate clinical challenges, reinforcing the importance of CoPs in structuring learning within uncertain environments [28].

In their line of work, healthcare professionals often face complex challenges that increase moral distress and vulnerability, particularly under extreme stress, as during the pandemic [14]. Our findings highlight that residency and fellowship programs fostered resilience primarily through a shared, collective process, rather than individual efforts. Although personal well-being is commonly considered a component of resilience, PD narratives emphasized the role of collective resilience, with fewer mentions of individual resilience. Collective resilience, which arises in the context of disasters and emergencies, is defined as a shared identification that allows groups of individuals to express solidarity and cohesion, drawing support through the shared experiences of the community in the face of adversities [22]. This shared resilience enables a shift in mindset, reframing distressing experiences as opportunities for growth through strengthened relationships [29]. CoPs play a critical role in fostering this form of resilience by providing a safe space for faculty and residents to openly share vulnerabilities and fears, collectively reflect on cases, and discuss how to manage similar situations in the future [22]. Current studies mostly highlight well-being interventions as either structural and organisational changes or as individual initiatives to promote personal resilience (14). Our findings underscore the importance of CoPs in cultivating collective resilience within residency and fellowship training and highlight the need for deliberate efforts to sustain such supportive environments during future crises.

Health professions education requires approaches that deconstruct issues of hierarchy and hegemony, which is a distinct cultural difference in international GME programs [30]. However, PDs repeatedly described how collaboration, communication, and strong support from seniors and supervisors across disciplines, along with the resulting flattening of hierarchy, contributed to resident adaptation during the pandemic. Experiential learning emphasizes the residents' experiences and their participative roles in the workplace, facilitating their development into independent medical professionals. Faculty played a key role in guiding residents through unfamiliar situations, engaging them in shared experiences, and encouraging them to learn from everyday clinical encounters while simultaneously taking responsibility for safe patient care. Faculty and residents not only supported each other in collective learning as the pandemic evolved but also shared their experiences to support their own learning about the novel disease. This process of collaborative learning and shared problem-solving enabled residents to integrate new knowledge into their practice more effectively.

Modern team-based healthcare requires members who can work and create in groups where learning arises through shared participative practices in authentic work [30]. Research shows that the most powerful factor influencing the journey from peripheral participation (becoming a health care professional) to full membership in the CoP (belonging to the healthcare team) is the involvement of role models and mentors in experiential learning [31]. The opportunity for role models to transfer both explicit and tacit knowledge to residents is central to moving them through the stages of competence, ultimately resulting in the master clinician [21, 32].

While our findings highlight the role of CoPs in fostering resilience and adaptation during the pandemic, they do not explicitly address how to establish a CoP when one does not currently exist. Based on our results, key steps in developing a CoP include identifying a shared purpose, fostering psychological safety, integrating faculty and residents across disciplines and levels of training, and creating structured opportunities for collaborative reflection and learning. Leadership support and intentional facilitation can help sustain these communities over time.



Fig. 2 Roadmap for future disruptions to graduate medical education. CoP: Community of Practice

Figure 2 provides a conceptual framework that illustrates how CoPs function during crises, while also offering a guide for programs seeking to establish or strengthen a CoP. By designing communities with clear goals, inclusive participation, and regular opportunities for engagement, programs can proactively build the collaborative learning environments that support resident development and well-being in times of both stability and disruption.

Future challenges to medicine and GME are undoubtedly on the horizon. The impact of climate change on health, the opportunities and challenges related to artificial intelligence, and the health challenges faced by refugees are just a few examples of potential disruptions to health care and GME. The lessons learned from the COVID-19 pandemic can inform how best to educate physicians in this future. Our findings can help residency programs purposefully design and foster CoPs in preparation for other large-scale disruptions to medical training.

Limitation

A key limitation of our study was that the data was collated from the narrative reflections of PDs in a survey; there was no opportunity to encourage further reflection and elaboration. Future studies with focus groups or interviews will be needed to explore the concepts further and to include perspectives of residents and other faculty.

Conclusion

Learning in a rapidly changing, complex environment during the COVID-19 pandemic required residents to learn and adapt with support from peers and senior physicians with a shared purpose. This accelerated experiential learning occurred through engagement with their community of practice across three dominant themes: capability building, fostering resilience, and collaborative working. Although residency programs demonstrated elements of a CoP, they may not have explicitly developed one. Our findings can inform programs on how the CoP framework can be leveraged to foster adaptive learning and resilience during future large-scale disruptions to medical training.

Abbreviations

ACGME-I	Accreditation Council for Graduate Medical					
	Education-International					
AHP	Academic Health Professionals					
CoP	Community of Practice					
COREQ	Consolidated criteria for reporting qualitative research					
GME	Graduate Medical Education					
PD	Program Director					
SOP	Standard Operating Procedures					

Author contributions

Study design: JO and HI. Collection and assembly of data: JO and SA. Data analysis and interpretation: HI, JO, SA. Original manuscript draft: JO and LL. All authors reviewed and approved the final manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

Ethics approval was obtained from the National University of Singapore Institutional Review Board (NUS IRB Reference No. 2020/01412) with a waiver for informed consent as data was de-identified and retrospective.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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