

Plastic Surgery amidst the Pandemic: The New York University Experience at the Epicenter of the COVID-19 Crisis

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Summary: The coronavirus disease of 2019 pandemic became a global threat in a matter of weeks, with its future implications yet to be defined. New York City was swiftly declared the epicenter of the pandemic in the United States as case numbers grew exponentially in a matter of days, quickly threatening to overwhelm the capacity of the health care system. This burgeoning crisis led practitioners across specialties to adapt and mobilize rapidly. Plastic surgeons and trainees within the New York University Langone Health system faced uncertainty in terms of future practice, in addition to immediate and long-term effects on undergraduate and graduate medical education. The administration remained vigilant and adaptive, enacting departmental policies prioritizing safety and productivity, with early deployment of faculty for clinical support at the front lines. The authors anticipate that this pandemic will have far-reaching effects on the future of plastic surgery education, trends in the pursuit of elective surgical procedures, and considerable consequences for certain research endeavors. Undoubtedly, there will be substantial impact on the physical and mental well-being of health care practitioners across specialties. Coordinated efforts and clear lines of communication between the Department of Plastic Surgery and its faculty and trainees allowed a concerted effort toward the immediate challenge of tempering the spread of coronavirus disease of 2019 and preserving structure and throughput for education and research. Adaptation and creativity have ultimately allowed for early rebooting of in-person clinical and surgical practice. The authors present their coordinated efforts and lessons gleaned from their experience to inform their community's preparedness as this formidable challenge evolves. (*Plast. Reconstr. Surg.* 148: 133e, 2021.)

New York City quickly emerged as the early epicenter of the novel SARS-CoV-2 [coronavirus disease of 2019 (COVID-19)] pandemic in the United States.¹ As case numbers continue to climb in select states, it is worthwhile to reflect on the proactive strategies put forth by institutions initially faced with the burgeoning health crisis that threatened to overwhelm key resources. New York City is the largest and most densely populated city in the country; both characteristics serve as clear contributors to New Yorkers' vulnerability to COVID-19 transmission.^{2,3} Susceptibility is further compounded by many New Yorkers' reliance on public transportation, where maintaining the recommended 6-foot

social distance is challenging. Notably, the city is also a major travel hub with a diverse complement of tourists and migrant workers. Of all testing for COVID-19 performed in the United States, by the end of April, New York City accounted for nearly 25 percent, representative of a preemptive approach to prioritize case identification.

At the heart of the New York metropolitan area lies the New York University Langone Health system, an academic medical center providing acute and quaternary care to the masses. With six primary inpatient locations across Manhattan, Brooklyn, and Long Island, and four affiliate institutions including New York City Health plus Hospitals Bellevue, Woodhull, Gouverneur, and the Veterans Affairs New York Harbor Healthcare System, New York University physicians serve a

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large proportion of New York City's population. Locations in Manhattan serve as the primary clinical sites for the New York University Grossman School of Medicine.^{4,5}

The Hansjörg Wyss Department of Plastic Surgery employs a diverse team of 16 attending surgeons, 21 current residents, and six clinical fellows. Residents and fellows participate in patient care across New York University Langone Health and affiliated hospitals, and head the resident-run ambulatory clinic. The response to COVID-19 was therefore a large-scale, coordinated endeavor with an emphasis on vigilance, proactive policy, and cooperation. The purpose of this article is to detail the Department's proactive response to the threat of COVID-19 at the epicenter of the pandemic and the early effects on plastic surgery training, research, and undergraduate medical education; and to define the role of plastic surgeons and trainees within the health care community during a global health crisis. It is our hope that this information will be of use to other departments and practices around the country and the world as the plastic surgery and associated professional communities adapt amidst this formidable challenge, and as we all prepare to face future tribulations.

DISTRIBUTION OF RESOURCES AND FACULTY REDEPLOYMENT

Since the initial surge of COVID-19 cases in the United States, the primary concern has become slowing the rate of disease transmission so as not to overwhelm the health care system.^{6,7} Compared across all surgical subspecialties, plastic surgery accounts for the largest fraction of elective procedures performed daily at New York University Langone Health. Although a significant proportion of plastic surgery cases are considered elective, reconstructive procedures following ablative operations including oncologic resections can be delayed only under specific circumstances. In addition, many pediatric operations must be timed appropriately to account for growth and development, such as primary cleft lip and palate repair, distraction osteogenesis, and staged reconstructive procedures for a broad range of craniofacial anomalies. Similarly, although some reconstructive procedures following trauma may be delayed and staged, other traumatic injuries require plastic surgery intervention during the acute phase.

In conjunction with emergency executive orders declared by Mayor Bill de Blasio of New York City, all elective surgical procedures were

cancelled or postponed effective March 16, 2020.⁸ New York University Langone Health defined elective surgery as "any clinical procedure that the physician and patient agree can be safely postponed for three months." This allowed for urgent and time-sensitive procedures to continue as planned, and the remaining equipment from ambulatory care facilities and laboratories was quickly inventoried and redistributed to critical areas. The Department engaged in systematic conservation of personal protective equipment, ventilators, and sterile instruments. Through these measures, we were able to support the medical center in its immediate goal of rapid diagnosis and treatment of symptomatic COVID-19 patients. Fortunately, through these conservative efforts, the medical center did not experience any critical equipment shortages.

Plastic surgery senior faculty and trainees were quickly mobilized to the front lines and integrated into patient care where need was evident. A survey link from the office of the surgeon in chief was distributed to all plastic surgery faculty to enlist as a volunteer in the "COVID Army." Our Department list was consolidated to a total of 16 eligible faculty, all of whom volunteered for redeployment. The chair of our Department (senior author, E.D.R.) worked to organize these eligible faculty members into three teams to allow for phased deployment. Teams were then deployed for 2-week blocks, for 4 days at a time, working 12-hour shifts in acute and subacute settings. April 3, 2020, marked the first multispecialty redeployment effort, which consisted of a team of five, including our Department chair and three plastic surgery faculty members. The team deployed for the following 2 weeks included two plastic surgery faculty members. To maximize efficiency, our faculty were paired together on the COVID floors. Simultaneously, eligible residents and fellows were organized and deployed to assist in the emergency department, intensive care unit, and on subacute floors across the health system. Residents were allowed to opt-out; however, the voluntary response was overwhelmingly positive. Based on need, nine residents in total, across all years of training, were redeployed to intensive care units throughout the medical center. COVID Army deployment rotations continued into early May, beyond reports that cases in New York City were on the downtrend.

The perspective gained from the early deployment of our more experienced senior faculty proved to be particularly valuable, especially in managing the expectations of patients' families,

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and in guiding junior faculty through conversations regarding end-of-life care. There was initially a propensity for early intubation in the disease process, as the pathophysiology of COVID-19 remained obscure and the overall ventilator need was underestimated. As in other centers globally, we observed that patients with advanced age and/or multiple medical comorbidities might remain ventilator-dependent for several weeks. Delaying decisions regarding life-sustaining measures and resuscitation ultimately placed more stress on family members then forced to decide whether to extubate palliatively or pursue placement of tracheostomy and gastrostomy feeding tube. In cases where do-not-resuscitate and/or do-not-intubate orders were established early, shift of focus was placed on comfort care, and selective family members were afforded the opportunity to don personal protective equipment and spend valuable moments with their loved ones at the bedside during the end of life.

IMPACT ON RESIDENT EDUCATION

Graduate medical education, particularly in surgical residency programs, relies largely on hands-on clinical training. Rotation-based schedules with strict duty-hour limitations were implemented to impede the possibility of health care workers serving as vectors of transmission. Inevitably, with the state of COVID-19 and shift of focus to care for an unprecedented number of critically ill patients, it was essential that residents across specialties remain adaptable and open-minded. Administrative decisions at New York University Langone Health system ultimately prioritized resident safety and well-being, while maximizing education and maintaining patient safety. The first precautions taken by our Department were travel restrictions to academic conferences and evaluation of nonessential travel made on February 28, 2020, which preceded but mirrored the institution-wide policy announced on March 3, 2020. As awareness of COVID-19 escalated, progressively more stringent policies were implemented to promote safety as outlined in [Figure 1](#).⁹ These policies included cancellation of visiting professorships and supplemental cadaver dissection workshops, in addition to converting educational meetings such as grand rounds, morbidity and mortality conference, and journal clubs to online platforms. In addition, weekly resident-run didactic sessions were implemented to provide further resident education on plastic surgery topics during the elective surgery hiatus. As positive

feedback was received, these sessions have continued and are planned to become an integral part of the curriculum moving forward.

Although the statewide motion to cancel all elective operations was necessary to protect patients and staff, and to conserve and reallocate critical supplies, this decision raised questions for the state of plastic surgery residency training. Some immediate implications included missed opportunities for peer mentorship and lost training experiences for junior residents. Whereas the dense population of New York City contributed to the disproportionate impact of COVID-19, this factor typically allows New York University residents to surpass required case mix minimums. Although the current state of affairs is not the conventional resident educational experience, it continues to be a challenging environment in which much can be learned. Ambulatory Faculty Group Practices have virtual capacity, including virtual postoperative visits and consultations. Despite evolving demands, no members of our Department at any level were furloughed or laid off. During the peak outbreak, only skeleton plastic surgery teams remained on service in-house; however, residents continued to take home-call and triage and treat emergencies as the health care system functioned at capacity.

Ultimately, the Accreditation Council for Graduate Medical Education with guidance from the Clinical Competency Committee places the responsibility on program directors to determine whether a resident or fellow is fit to proceed to unsupervised practice.¹⁰ Although caseload can provide one potential measure of competence, residents and fellows are critically assessed on their performance of well-defined milestones and clinical competencies, which prioritize outcomes-based assessments over time-based models.¹¹ This allows for flexibility within the residency training program to respond appropriately to crises such as COVID-19 without compromising the quality of plastic surgery training. However, the close and continuous monitoring of the situation continues so as to evaluate the full extent and duration of the pandemic's impact on graduate medical education.

IMPACT ON UNDERGRADUATE MEDICAL EDUCATION

The future of undergraduate medical education also faces its own challenges that may influence pipelines into plastic surgery. New York University Grossman School of Medicine swiftly

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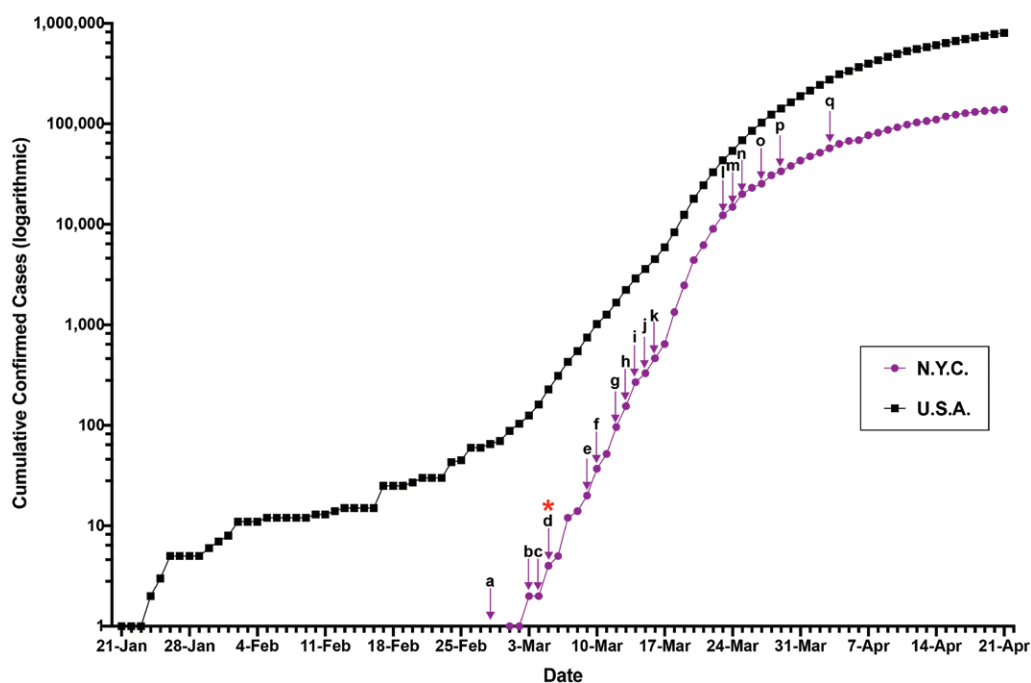


Fig. 1. Timeline of cumulative confirmed cases (logarithmic scale) in the United States and New York City with corresponding early enactment of institutional and departmental policies. *Asterisk*, first confirmed case at a New York University–affiliated hospital; *a*, departmental cancellation of attendance at academic conferences; *b*, institutional cancellation of business-related travel, interviews, and visiting professorships; *c*, medical school cancellation of visiting and away electives for students; *d*, restriction on gatherings with more than five participants from outside institutions; *e*, resident wellness social event cancelled; *f*, operating room student presence restricted to conserve personal protective equipment; *g*, plastic surgery anatomy and surgical skills training for preclinical students postponed; *h*, all classes for preclinical students converted to virtual platform; *i*, medical students removed from clinical rotations; *j*, instatement of work-from-home policy for clinical research and departmental staff; *k*, cancellation of all elective surgical cases and citywide closure of all public schools; *l*, enactment of basic science and translational research restrictions; *m*, announcement of early medical student graduation option; *n*, departmental educational lectures converted to online platforms; *o*, ambulatory faculty group practices go virtual; *p*, request for faculty, fellows, and residents to join the COVID Army; *q*, first multispecialty faculty deployment and virtual New York University Grossman School of Medicine graduation ceremony.

responded to COVID-19 by transforming all preclinical education to virtual classrooms, postponing in-person clinical rotations, and offering elective credit for online coursework. Particular focus was placed on rotations with operative experience, as early restrictions limited one student per operative procedure as an additional measure to conserve personal protective equipment. Cancellation of clinical rotations was initially announced as a 60-day hiatus, and applied to both present and future rotations and visiting and away elective rotations. Restrictions have now continued into the peak subinternship season, with the fate of these rotations and subsequent impact on the upcoming residency application cycle remaining to be seen. The importance of away rotations for both plastic surgery applicants and programs

is well established and will need to be addressed.¹² The potential long-term implications for graduates with reduced or alternative clinical experiences should also be considered.

Continued medical student exposure to clinical and academic plastic surgery is critical to maintain interest in the field. It has been shown that students have misconceptions about the scope of plastic surgery,^{13,14} and their decisions to pursue the specialty depend on clinical experience and mentorship.^{15,16} The impact of COVID-19–related cancellations can therefore be far-reaching. In accordance with resident education restrictions and medical school policy, our supplemental plastic surgery anatomy and surgical skills training course was postponed. This hands-on course provides early exposure opportunities for

preclinical students, and virtual alternatives are being explored.

On March 24, 2020, New York University Grossman School of Medicine announced the potential for early graduation for eligible students, to siphon new graduates into primary care and emergency medicine and increase the overall resident complement. After a virtual graduation ceremony on April 3, 2020, these new doctors prepared to join the internal medicine and emergency medicine departments on the front lines. Other U.S. medical schools have enacted a similar policy.¹⁷ Residency programs then grappled with the logistic details of starting with active interns who may require quarantine or other accommodations, while also considering the potential physical and emotional impact of a first clinical experience characterized by the front lines of a global health crisis.

IMPACT ON RESEARCH ACTIVITIES

The Department of Plastic Surgery at New York University Langone Health system places great emphasis on the importance of research productivity.¹⁸ The COVID-19 pandemic has required the establishment of policies to prioritize employees' safety, thereby affecting basic laboratory, translational, and clinical research efforts.

Clinical Research

The first goal was to maintain productivity in-house and prioritize the safety of our faculty and staff by reducing travel and potential exposure. As an early response to the threat posed by COVID-19, our Department enacted a policy as of February 28, 2020, affecting attendance at several academic conferences, both international and domestic. To date, all accepted abstracts have been retracted from the following 2020 conferences: American Society of Plastic Surgeons, American Cleft Palate-Craniofacial Association, American Association of Plastic Surgeons, Wound Healing Society, and Plastic Surgery Research Council. In an effort to further protect our staff, a policy issued on March 5, 2020, subsequently restricted attendance at local meetings and conferences, even those held in New York City, when greater than five participants were from outside institutions. As the national situation evolved, however, nearly all of the aforementioned meetings were subsequently postponed, cancelled, or converted to virtual platforms by the organizers.

A departmental policy issued on March 15, 2020, required all clinical research staff to work

independently from home instead of reporting to their respective offices. Frequent communication, team meetings, and collaboration with outside parties have been maintained by means of remote technology. Because many elements of clinical research such as conceptualization, literature review, most data collection, and manuscript preparation can be completed remotely, the clinical research staff has been able to continue much of their research efforts, with minimal impact on overall productivity and maintenance of the synergistic effect of collaboration and creative interactions through virtual connection. Of course, most prospective data collection for projects dealing with human subjects has been affected and largely postponed. Because of cancellation of elective and nonemergent operations, and significant reduction in frequency of in-person office visits, many research studies and reports have been temporarily suspended. Furthermore, logistic constraints on the research staff affecting the quality of the work environment at home should also be noted. These include the need to balance work with concomitant parental duties resulting from closure of schools and daycare facilities. Certain childcare services made available to residents and fellows have helped to alleviate this strain.

With domestic and international travel effectively halted until further notice, access to care for non-New York City natives will be substantially impeded. Our Department's experience with facial transplantation has contributed substantially to the field of vascularized composite allotransplantation, with two face transplants performed at the institution since 2015 and plans for prospective procedures on the horizon.^{19,20} The future of this practice is yet uncertain, not only because reconstructive transplantation procedures involve recruitment of a large team of personnel and extensive preparation and supplies, but also because there is great controversy in inducing immunosuppressive therapy after transplantation of an allograft for a non-life-saving purpose, particularly in the midst of a global pandemic.²¹ Donor selection remains a formidable challenge, with the added risk of infectious exposure.

Basic Science Research

A strict but necessary institution-wide policy issued on March 23, 2020, posed considerable restriction on laboratory-based research activities in an effort to protect staff. Under this new policy, access to all laboratories was limited to one person per principal investigator's research team at

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any one time, for a limited number of hours at a time. In addition, restrictions were placed on the allowable activities performed during laboratory hours, thus prohibiting experimental work. These hours were instead allotted to assurance of animal welfare and monitoring of sensitive chemical elements. At the time of this writing, several of our basic science and translational research activities requiring physical laboratory presence remain effectively halted, with researchers' time and effort otherwise reinvested in remote tasks such as grant applications and manuscript writing.

Summer Research Internship

Since 2013, our Department has offered a summer research fellowship opportunity consisting of both a basic science arm and a clinical research arm. For the 2020 program, six medical students between their first and second years were selected from a pool of nearly 100 applicants. To preserve this experience, the entire curriculum was converted to online platforms, with the aid of video conferencing to conduct laboratory meetings, journal clubs, and basic surgical skills sessions. Students were guided through critical appraisal of key literature, with emphasis on conducting systematic reviews and meta-analyses. The program format was well received, with 100 percent participation by all invited students despite the changes, and each student approaching the end of the summer with at least one first-author manuscript in preparation for submission.

THE FUTURE OF PLASTIC SURGERY AND DEPARTMENTAL REBOOTING

The fundamental question across specialties remains: How will the world's experience with the COVID-19 pandemic change the face of health care as we know it? Several scenarios have already raised the question of what constitutes necessity for placing a plastic surgery consultation, and challenges the utility of obtaining an in-person medical history and performing a comprehensive physical examination. Although information gathering is essential, we must be more creative and resourceful in our methods than ever before. As much of the health care workforce is siphoned into emergency medicine, primary care, and critical care, it is worth also considering whether medical student attitudes and interests will follow suit. The experience of a global public health crisis is sure to affect decisions related to specialty choice, particularly when clinical experience in certain areas, although perhaps temporarily, has

been altered.²²⁻²⁴ The next several months will be paramount in determining the ultimate effects on plastic surgery training and practice, as programs across the country rally to respond accordingly.^{25,26}

As the medical center reenters more regular clinical practice, department-specific rebooting presents a new challenge. The electronic "daily symptom check" system has been implemented for all employees, to be used as a screening tool and to monitor employee travel to endemic areas. COVID versus non-COVID units have been consolidated, and terminal cleaning was conducted to allow for safe repopulation. The Department of Plastic Surgery alone was tasked with the reorganization of over 200 deferred cases. These have been prioritized based on available operating room time, with use exceeding 100 percent whenever possible. Because a formulaic rescheduling process could not realistically be implemented, in general, complex reconstructions for cancer and trauma and time-sensitive pediatric cases were prioritized, based on scrutiny of individual circumstances, including patient and caretaker preference. All patients are required to undergo antigen testing at a designated New York University center within 48 hours of their scheduled procedure, and all operating room personnel are screened for symptoms and relevant exposures since their last negative test. All decisions were ultimately reviewed and cleared by the operating surgeon, Department chair, and chief medical officer. As we look ahead, key quality improvement and research activities will explore the uses and potential limitations of telemedicine platforms in plastic and reconstructive surgery, including its lasting incorporation into clinical practice. As more data become available, future investigations will focus on specifics regarding our rebooting practices.

CONCLUSIONS

Although the long-term impact on our field and health care in general is yet uncertain, we must maintain vigilance, composure, and cooperation in trying times. Our Department's initiatives remain focused on safety for faculty, residents, and students while optimizing patient care, including comfort measures and communication with families, and minimizing any detriments to medical education and research. The plastic surgery community has long been characterized by its members' unique propensity for adaptation and creativity; both of these statutes will serve well, as the future is yet uncertain.

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