BIOMEDICAL POLICY

Academic careers and the COVID-19 pandemic: Reversing the tide

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The COVID-19 pandemic halted research operations at academic medical centers. This shutdown has adversely affected research infrastructure, the current research workforce, and the research pipeline. We discuss the impact of the pandemic on overall research operations, examine its disproportionate effect on underrepresented minority researchers, and provide concrete strategies to reverse these losses.

INTRODUCTION

In March 2020, the United States experienced the first peak of coronavirus disease 2019 (COVID-19) cases (*1*). In an effort to flatten the curve of the ensuing COVID-19 pandemic, academic medical centers across the country reduced their operations by limiting patient care to urgent and emergent concerns, moving a large proportion of personnel to work virtually from home, and restricting operations not related to direct patient care or COVID-19. Although the initiatives taken to address the pandemic were essential, it is important to assess and understand the impact they have had on scientists and on the research enterprise.

Most researchers at academic medical centers, including basic science, clinical, health service, and public health scientists, were negatively affected by the changes in response to the COVID-19 pandemic. These restrictions resulted in laboratory closures and halted research studies. Some laboratories were asked to donate personal protective equipment (PPE) to clinical operations, whereas others were diverted toward developing COVID-19–specific assays and reagents. Intramural research accounts were frozen to support the medical mission, whereas extramural funding sources such as those of the National Institutes of Health (NIH) offered little financial relief for investigators. Some physician-scientist principal investigators were called on to markedly increase their clinical effort during the surge of patients with COVID-19. In addition to these institutional changes, widespread cancellation of academic conferences and delays in institutional review boards and peer review by academic journals negatively affected the ability of researchers to initiate, complete, and disseminate research findings. Consequently, researchers experienced marked losses in research productivity (*2*), leading to stalled professional advancement and reduced opportunities for professional development.

Before the COVID-19 pandemic, underrepresented minority (URM) researchers were already challenged by smaller professional networks and less mentorship compared to White researchers (*3*–*5*), a decreased likelihood of receiving NIH grants (*6*), and overall smaller research operations (*7*, *8*). COVID-19–related disruptions in scientific research have compounded an already stressed reality. Here, we delineate how the pandemic has affected the entire research community and how it has disproportionately harmed URM researchers. We also give recommendations for the retention of URM researchers in this new normal and show how improving conditions for URM faculty improves conditions for everyone.

THE PREPANDEMIC LANDSCAPE

There are 154 medical schools in the United States and about 180,000 full-time faculty within those schools, of which, 88% are in clinical science departments and 11% are in basic science departments (*9*). The American Association of Medical Colleges has determined that 10% of all academic medical center faculty are URMs (*9*), defined by the NIH as Black or African American, Hispanic or Latino, American Indian or Alaska Native, Native Hawaiian, and other Pacific Islander (*10*). The pipeline of URM medical students does not provide hope that these numbers will increase. Whereas medical school enrollment doubled over the past two decades, the percentage of entering URM students actually fell by 16%, further threatening the future representation of URM investigators at academic medical centers (*11*). The pipeline for underrepresented minorities in nonclinical science, technology, engineering, and mathematics fields—many of whom work in academic medical centers—is similarly discouraging, with URMs representing less than 5% of postdoctoral scholars (*12*).

In 2019, there were 45,334 total NIH grants received by academic medical centers and affiliated hospitals, supporting 41,019 researchers including about 28,000 principal investigators. In aggregate, in fiscal year 2019, schools of medicine (the major recipients of NIH funding) received about $15 billion of NIH research funding (*13*). A total of 94% of all NIH funding is awarded to White and Asian researchers, whereas 2 and 4% are awarded to Black and Latino researchers, respectively (*14*). A 2011 study by Ginther *et al.* demonstrated that Black researchers who applied for NIH grants were 13% less likely to receive NIH investigator-initiated research funding compared to White applicants. After controlling for the applicants' educational background, country of origin, training, previous research awards, publication record, and employer characteristics, Black applicants remained 10% less likely than White applicants to be awarded NIH research funding (*6*). Examining data beyond the study period used by Ginther *et al.*, the Advisory Committee to the Director Working Group on Diversity in the Biomedical Research Workforce led by H. Valantine found that differences in success rates between White and Black applicants persisted between 2006 and 2015

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(*7*, *15*). An analysis to identify underlying causes of the racial NIH funding gap revealed that Black applicants tend to propose research on topics with lower award rates, such as community and population health, accounting for more than 20% of the funding gap (*16*). These data are important to highlight as a backdrop for the disproportionate impact of the COVID-19 shutdown on URM researchers at academic medical centers.

COVID-19 IMPACT ON RESEARCH OPERATIONS, INFRASTRUCTURE, AND FINANCES

A recent publication by Myers *et al.* (*2*) established that since the onset of the COVID-19 pandemic and shutdown of research operations, faculty have lost on average 24% of their research productivity. The greatest impact has been felt by laboratory-based scientists, who lost 30 to 40% of their productivity. Female scientists and, particularly, female scientists with young children have experienced the greatest burden, with those with dependents under the age of 5 losing over 45% of their research time (*2*, *17*, *18*). There were either no data or a limited number of URM researchers included in these studies to examine the impact of COVID-19 on URM faculty.

There are many reasons for pandemic-related losses in research productivity, including changes in research infrastructure, adaptation to new remote team dynamics, suboptimal home virtual environments, competition between work and home obligations, and direct effects of psychological stress on work performance. These COVID-19–attributed effects are experienced by the full spectrum of researchers in academic medical centers, from basic scientists to clinical researchers. Basic laboratory researchers have lost critical resources such as research animals, reagents, and supplies due to the shutdown and diversion of supplies to the hospitals for clinical use. Clinical researchers have had to halt patient recruitment and enrollment for non–COVID-19–related studies, while still supporting research staff, without an ability to recover funds. These researchers also suffer from the additional challenge of clinical research subjects being afraid to return to clinical spaces because of the pandemic. Data scientists, epidemiologists, and health services researchers have had reduced access to specialized software and datasets that may be housed behind institutional firewalls. Researchers who have grants with an educational component have had to cancel in-person teaching activities and hope that any quickly developed virtual alternatives suffice. Researchers across the spectrum have had to contend with inconsistent access to administrators due to mandatory furloughs and inadequate home-based technology to support research operations.

In addition to the loss of valuable time and research data, the research shutdown has had a big financial impact. Whereas studies need to be performed to quantify the full extent of financial losses to researchers, an informal survey of our own research faculty estimates that during the 3 months of full laboratory closure, researchers incurred financial losses of U.S. $2000 to $100,000 per research program, amounts that, depending on the research program's size, could threaten the survival of that research program.

COVID-19 IMPACT ON THE CURRENT RESEARCH WORKFORCE AND PIPELINE

The professional advancement of research faculty within academic medical centers depends largely on research productivity as defined by traditional metrics, such as publications and grant funding. Because the shutdown of non–COVID-19–related research operations has stymied research progress, there will likely be profound short-term and long-term impacts on the current and future research workforce.

For students and trainees, research opportunities have either been delayed or canceled, thus affecting their ability to compete for future positions, graduate school entry, and medical school admissions. Whereas some opportunities for unpaid virtual positions have remained available, students and trainees are not equally able to accept unpaid research positions. We suspect that URM predoctoral students and trainees have been less likely to work without pay, given that an estimated 80 to 90% of these minority trainees receive financial aid to pay for postsecondary education, compared with 74% receipt of financial aid by White students (*16*). Many of these URM students and trainees have had to assume second jobs that prevent them from taking on unpaid research opportunities. In the setting of an already leaky pipeline in academia (*12*, *19*, *20*), a disparate loss of opportunities is likely to further disadvantage the very students who hold the potential for creating a more diverse and inclusive workforce.

A DISPROPORTIONATE IMPACT ON URM RESEARCHERS

URM researchers are uniquely vulnerable to the disruptions wrought by the pandemic. URM researchers working in academia are less likely to receive NIH funding, generally have fewer mentorship relationships, and have smaller networks and fewer sponsorship opportunities than do their nonminority counterparts (*21*). However, URM researchers contribute to scientific innovation at high rates, a phenomena recently named "the diversity-innovation paradox in science" (*22*). The result is that URM researchers have smaller research programs that increase their vulnerability to a COVID-19–related shutdown of research operations (*7*, *8*).

URM researchers are also more likely to be on career tracks for physicians and are less likely to be on a tenure track career route. This makes them more likely to be asked to cover clinical services to address the rising numbers of critically ill patients with COVID-19 (*23*). In addition to their greater clinical obligations, URM researchers are routinely called upon to devote more hours toward service to their departments and institutions than their peers. This service burden for URM researchers at academic medical centers is known as the "minority tax" (*24*). Somewhat ironically at the expense of their other career goals, URM researchers have experienced an increase in this "tax" in the wake of the killing of George Floyd in May 2020, as many have felt compelled or been asked to take on roles related to helping direct the responses of their institutions to calls for increased diversity, equity, inclusion, and antiracism (*25*, *26*). URM women researchers are especially affected by the minority tax, because they experience an even greater obligation to fulfill service roles (*27*).

During a period of institutional recovery from the shutdown, additional service burdens may worsen inequity, hampering the ability of URM researchers to devote time to their own academic goals and achieve key milestones such as promotion and tenure. These interrelated processes can promote attrition of URM researchers in academic medical centers, a group whose promotion to senior academic ranks is already substantively lower than their nonminority peers (*28*). As URM researchers are more likely than other groups to engage in research of underserved populations (*29*–*31*), this attrition is likely to have long-term effects on research (and consequently the health) of minority communities. Last, note that URM women researchers—who belong to more than one marginalized group in academia—are likely to be especially vulnerable to the hardships imposed by the COVID-19 pandemic. Whereas the additional burden of being both a minority and a woman in research has not been fully quantified and should be examined, we and others have argued that their combined impact is likely more than additive (*32*–*34*).

STRATEGIES TO ADDRESS THE NEEDS OF URM RESEARCHERS

To reverse the trend of loss of productivity among URM researchers, academic medical centers should couple their clinical mission of combating COVID-19 with the equally important mission of ensuring a viable research infrastructure to sustain investigators during and beyond the COVID-19 pandemic (Table 1). Failure to invest in the latter now will likely result in loss of a cohort of both URM and non-URM researchers who are at their prime in research potential, the impact of which will be felt for many years to come.

Recalibrating institutions to bolster the careers of URM researchers

Pandemic-related budgetary pressures have or threaten to reduce money previously devoted to diversity, equity, and inclusion offices and efforts. These offices and initiatives provide support to URM faculty in the form of recruitment, career development, and networking. Eliminating or reducing funding to these structures will worsen the disproportionate impact on URM researchers. Instead, the research structures at academic medical centers should explicitly partner with offices of diversity, inclusion, and equity to engage URM researchers to develop concrete strategies to mitigate the impact of COVID-19 on investigators. For example, rather than providing resources that are normally made available to researchers in a "need-blind" way, which often results in support for research teams that are already well funded, institutions should invest directly in URM researchers. Institutional bridge funding (short-term funds made available to investigators to offset COVID-19–related losses), distributed in an equitable way, could also ameliorate such budget constraints.

Academic medical centers should also take better advantage of the NIH diversity supplements to help offset institutional costs incurred by hiring URM students and protecting URM faculty time. This resource is currently underused (*35*), perhaps reflecting either a dearth of diverse researchers at institutions or a lack of broadscale support systems within academic medical centers that identify, track, and sponsor individuals from diverse backgrounds. To address the latter challenge, academic medical centers should use this pandemic recalibration period to develop institutional databases of URM faculty for the purposes of accounting and monitoring academic progress and establishing multitiered mentorship structures to support their career development. By paying specific attention to this demographic, institutions will more quickly recognize and intervene on factors that contribute to faculty attrition. These tools will likely pay dividends for years to come as academic medical centers use these databases in a longitudinal way to determine the success of URM-targeted programming.

Last, academic medical centers must begin to accurately measure the unrecognized

Table 1. Strategies for academic medical centers to address pandemic-related researcher needs.

Strategies to mitigate the impact on research operations and infrastructure
Create internal bridge funding by crowdsourcing existing departmental and university funds.
Follow a ride-share model by creating common pools of administrators and research staff to fill work gaps created by hiring freezes and financial constraints.
Promote use of existing multi-institutional databases to generate primary data during the pandemic.
Improve efficiency of internal review boards through increased operational support.
Negotiate bulk purchase rates for laboratory reagents and other supplies at the institutional level.
Build and enhance local outreach campaigns to increase access to COVID-19–related and non–COVID-19–related health care to combat inequities and encourage reengagement with clinical research.
Strategies to mitigate the impact on the research workforce and research pipelines
Automatically extend promotion probationary periods and provide an opt-out option.
Measure, recognize, and reward community outreach and advocacy in promotion processes.
Reinstitute paid research opportunities for students, trainees, and recent graduates given their financial and career vulnerabilities.
Use bridge programs for T32-supported trainees facing hiring difficulties due to hiring freezes.
Extend protected time accommodations for unfunded early career faculty suffering disproportionate pandemic-related impact.
Strategies to bolster the careers of URM researchers disproportionately affected by the pandemic
Develop concrete guidelines to track the equitable use of institutional bridge funds.
Earmark new internal bridge funds for URM researchers.
Increase the availability and use of NIH diversity supplements to support URM researchers.
Develop institutional databases of URM researchers to assist with accountability and multitiered mentorship structures.
Recognize and reward the disproportionate service work performed by URM researchers; include these efforts in promotion metrics, honorary appointments, or full-time equivalent hours.

service that falls on the shoulders of URM faculty. We cannot value what we do not measure. A section in all curricula vitae should be devoted to service to and impact in the community. Community can be defined as local, regional, national, or international. Not doing so may disadvantage their own schools when competing for large center grants that require competence and innovation in the scientific engagement with the community. Schools and universities should also recognize and celebrate scientific engagement with and service to communities. Doing so will enhance their value and engender trust in communities. It will also help to recruit more URM researchers, as many if not most of them are committed to serving communities. This is particularly important given the growing distrust in institutions and discounting of science by the general public. Some institutions already recognize and measure this type of service, and some publicly value and reward it.

Mitigating effects of the shutdown on the research workforce and research pipeline

Academic medical centers should recommit to investing in the equity mission, in researchers themselves, and in the research pipeline. Specifically, promotion processes should be examined and adjusted to ensure that those approaching promotion are not unjustly penalized for lapses in productivity during the pandemic. Many institutions around the country, including our own, are providing automatic COVID-19 probationary period extensions with an opt-out option. Promotions committees can use the review process as an opportunity to ensure that all activities in which faculty are engaged receive appropriate academic credit. This includes community outreach engagement, which has become a requirement to successfully compete for NIH support of clinical centers, e.g., National Cancer Institute (NCI) Comprehensive Cancer Centers, and for Clinical and Translational Scientific Awards. Community outreach, advocacy, and engagement should become core values of all academic medical centers and should be recognized by leadership and promotions criteria. These activities are critical for engaging diverse individuals in the clinical research conducted at academic medical centers and for the translation, dissemination, and implementation of research back to communities, thereby broadening the impact of the research. Briefly, academic institutions should include a broader definition of academic excellence and productivity so that researchers (and all faculty) get credit for a wider range of highly meritorious academic activities. These updated metrics should include nontraditional categories, such as advocacy and nonresearch-based community service, two areas that are often important parts of the careers of URM researchers (*24*).

Institutions should immediately cease hiring freezes that prevent students, recent graduates, and trainees from being hired for paid research opportunities, as these are the most vulnerable among us. More than ever, these trainees need such opportunities to shore up their future as academics. They are also a critical resource for early faculty investigators seeking to establish their own research programs. Moreover, these research positions are often funded by grants that are still active. So, whereas hiring freezes may seem sensible to portions of academic medical centers that are supported by clinical revenue, they are not sensible for research-funded positions. Academic medical centers should also consider providing bridge funding for institutional training grant (T32)–supported trainees who are near the end of their funding period and desire a research career in academic medicine but who have no opportunity to be hired as faculty because of national hiring freezes. During this extension, trainees should receive coordinated, department-level logistical support in converting this funding into individual postdoctoral training grants (F32) and equivalent mechanisms. Principal investigators should assist trainees in negotiating extensions with their NIH program officers where applicable, on the basis of the new NIH guidance (*36*). New faculty who have recently transitioned from trainee status should have their protected time extended to accommodate delays in getting their research restarted, especially as they are likely to have suffered a disproportionate effect of hiring freeze policies and summer research cancellations that prevent access to technicians and students who comprise the majority of their research program personnel.

Last, academic medical centers would be remiss in their commitment to the research workforce without acknowledging the real constraints that growing child- and eldercare responsibilities place on researchers during the COVID-19 pandemic. Traditional supports such as schools and facilities for daycare and eldercare are either unavailable, have limited availability, or pose an increased risk of COVID-19 exposure, making the options untenable. Myers *et al.* (*2*) reported that women academics with young children are the most vulnerable to these competing responsibilities. Traditional models of solving these problems include building and maintaining campus-based facilities. However, given current resource constraints, academic medical centers should consider contemporary models of curating resources for families, including cooperative childcare apps and internal childcare marketplaces within institutions (*37*). These supports should continue to be made available after the pandemic, as many corporations have already demonstrated increased workplace productivity when these resources are provided (*38*).

Mitigating effects of the shutdown on research operations and infrastructure

Leaders at academic medical centers should engage contemporary rather than traditional models of innovation and sustainability to buttress research operations and infrastructure during the COVID-19 pandemic. Traditional models rely on a siloed approach in which each investigator finds unique resources to sustain one's research program. When investigator time and resources are scarce (as during the pandemic), this model is unlikely to be successful for most researchers, and even less so for URM researchers who traditionally have less access to these resources. By applying contemporary models of resource building that are now commonplace in nonacademic settings, academic medical centers can help to bridge researchers past this crisis. For example, departmental heads of research can apply the principle of "crowdsourcing" to secure new sources of institutional funds to create a COVID-19 bridge fund. According to the *Merriam-Webster Dictionary*, crowdsourcing is the "practice of obtaining needed services, ideas, or content by soliciting contributions from a large group of people." Outside of institutions, this strategy is often used by individuals to fundraise over the internet but is increasingly being applied to health data (*39*). One silver lining to the pandemic is its illustration of how we can come together as health care systems to develop new models of care, changing the course of titanic organizations with a nimbleness usually thought to be impossible. We can apply this same innovative spirit to saving our research infrastructure. By partnering with both departmental and university leaders who can each contribute a portion of their earmarked research funds, research officers can effectively crowdsource sufficient financial resources to create a bridge fund that supports researchers who either experience a lapse in funding during the pandemic or need reimbursement for redeployment and loss of personnel, supplies, and PPE. Whereas this strategy can benefit all researchers, academic medical centers would need to create clear guidelines about how these funds can be used and have a mechanism in place to track the equitable use of these bridge funds and their success in sustaining investigators. In addition, academic medical centers should ensure access to bridge funds designed to support the retention and development of URM investigators.

The nature of the pandemic has left some laboratories with staff and no work to be done (because of laboratory closures) and others with work to be done but no staff (because of staff redeployment to the clinical mission). Traditionally, this latter problem could be resolved by hiring temporary personnel. However, because of institutional financial constraints and hiring freezes, this solution is often unavailable. To help address this need, institutions could adapt the "ride-share" concept by allowing investigators to share a common pool of administrators, research coordinators, technicians, and biostatistical staff to help reboot their research as laboratories begin to reopen. This solution would likely require partnerships with extramural funding agencies such as the NIH whose grants fund these positions. In this extraordinary time, it is our hope that these agencies recognize that repurposing persons whose specific grant-funded labor is already paid for but impossible to put to its original use (i.e., a sunk cost) represents a net gain for their overall mission rather than further loss.

Investigators who are constrained in their ability to generate primary data due to the slow pace of laboratory reopenings and loss of critical resources can use shared data to make valuable and innovative contributions while remaining academically productive. Similar to industries that share data across geographic lines (e.g., the airline and weather industries), academic medical centers should embark upon new investments in multi-institutional databases, which are rich and timeless resources for scientific discovery. This strategy would have the additional effect of addressing the lack of generalizability and ethnic diversity that plagues most population-based studies. Larger centers should partner with smaller institutions, including minority serving institutions, to develop these databanks. Partners could share the cost of a central biostatistical resource responsible for data mining, akin to what the U.S. Department of Veterans Affairs has developed for its Million Veteran Program initiative (*40*) or the U.K. Biobank (*41*). As laboratories are reopening, academic medical centers can accelerate the pace at which researchers recover lost productivity by improving the efficiency of internal review board processes. Traditionally, it takes weeks to months to gain Institutional Review Board (IRB) and Institutional Animal Care and Use Committee (IACUC) approvals. By increasing the operational support for IRB and IACUC offices, reviews of proposals that involve human and animal research can be expedited. Improving the efficiency of these reviews reduces the lag time between physical reopening and restarting of research projects. This time-saving measure will ultimately translate into cost savings, as accrued data can support new grant funding. Another contemporary cost-saving tactic that can be used by academic medical centers is taking a "big box" company approach of aggressively negotiating lower prices for reagents and supplies so that investigators can benefit from bulk-buying rates. This strategy is especially important for investigators who have effectively lost a portion of their grant-funded research budget because of continuing to pay for personnel during the laboratory shutdown.

Last, to support and engage those communities that contribute directly and indirectly to research efforts, academic medical centers have an ethical obligation to improve access to COVID-19–related and non–COVID-19–related health care. Furthermore, many academic medical centers receive NIH funding for centers (such as NCI Comprehensive Cancer Centers) and infrastructure (such as Clinical and Translational Science Awards) that is specifically for outreach and engagement of communities of color in NIH-sponsored research. Institutions should develop direct outreach campaigns to educate local populations about COVID-19, address the disproportionate impact of COVID-19 on communities of color by increasing access to testing in these communities, highlight the importance of research to eradicate the virus, and showcase the critical role all researchers play in improving the general health of communities. We expect that these measures would improve the relationships between academic medical centers and community members, encourage reengagement with clinical research, and further reduce the lag time between research resumption and subject recruitment or follow-up.

CONCLUSION

The COVID-19 pandemic has had far-reaching effects on all sectors of society. Academic medical centers have not been spared, and research faculty within these institutions are uniquely affected not only because of their contributions to COVID-19–related clinical operations but also because of barriers to non–COVID-19–related research operations. Among these research faculty, URM faculty are especially vulnerable given baseline disparities in research, operational, and network support. Whereas many research programs have been allowed to resume operations, many are still not at 100% capacity due to public health restrictions and the impact of the loss of personnel or funds. Academic medical centers should mobilize available resources within and across institutions to limit the long-term effects of the pandemic-induced shutdown on research infrastructure and the workforce, offering targeted mechanisms to address the widening disparities experienced by URM researchers. In this way, academic medical centers may be able to prevent the negative consequences on science and medicine that come with the attrition of diverse members of the academic community.

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Funding: R.M.C. is supported by NIH grants R01 AA026302 and P30 DK0503060. M.B.L.-F. is supported by NIH grants R01 HL153735, P30 AG059302, and UM1 HL088957. E.S. is supported by the RWJ Harold Amos Medical Faculty Development Program grant #76233. C.E.G. is supported by NIH grants P30 CA 016520 and U54 MD010706. R.H. is supported by PR 191513 (DoD), R01 AG059763, R01 DC016800, P30 AG010124, and R01 DC015359. **Competing interests:** R.M.C. has received research support from Intercept Pharmaceuticals and Merck Pharmaceuticals.

10.1126/scitranslmed.abe7189

Citation: R. M. Carr, M. B. Lane-Fall, E. South, D. Brady, F. Momplaisir, C. E. Guerra, D. Montoya-Williams, G. Dalembert, R. Lavizzo-Mourey, R. Hamilton, Academic careers and the COVID-19 pandemic: Reversing the tide. *Sci. Transl. Med.* **13**, eabe7189 (2021).

Science Translational Medicine

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Sci Transl Med **13**, eabe7189.
DOI: 10.1126/scitranslmed.abe7189