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Guest Editorial



Leaving no stone unturned: The National Institute of Dental and Craniofacial Research's scientific response to COVID-19

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CCOVID-19 is a new human infectious disease that is caused by a novel coronavirus called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It emerged in December 2019 and owing to its rapid spread worldwide, was declared a pandemic by the World Health Organization in March of 2020. Although the molecular mechanisms of SARS-CoV-2 viral infection and the interactions of the pathogen with host tissues remain unclear today, the crisis has garnered the interest and commitment to biomedical research among communities around the globe.^{1,2}

Recognizing COVID-19 was a rapidly-emerging public health crisis, the National Institutes of Health (NIH) was quick to lead a coordinated response that prioritized research about the biology of SARS-CoV-2 and the pathogenesis of COVID-19. Studies were launched to develop novel tools and approaches that better diagnose, prevent and treat this dreadful disease and also to prevent and redress COVID-19 outcomes in vulnerable populations.³

NIH institutes, centers, and offices released numerous funding opportunity announcements and notices of special interest (NOSI) for accelerating COVID-19 research; from basic biology on the mechanisms of infection and transmission of SARS-CoV-2, as well as the onset, progression, and resolution of COVID-19, to clinical approaches on prevention and treatment, and technologies for detection and diagnosis. The National Institute of Dental and Craniofacial Research (NIDCR) capitalized on the strengths and readiness of its extramural and intramural research infrastructures to launch several initiatives. Specifically, NIDCR released 2 NOSI encouraging research of immediate and high impact to protect and ensure the safety of personnel and patients in dental practices during the pandemic. These high-priority topics include prevention of SARS-CoV-2 transmission and improvements in the detection and diagnosis of COVID-19, as well as acquisition of a more robust understanding of SARS-CoV-2 pathogenesis.

Through these 2 solicitations, NIDCR is supporting several 1-year projects that use the infrastructure of the National Dental Practice-Based Research Network⁴ to investigate the transmissibility of SARS-CoV-2 through aerosols or contaminated personal protective equipment, and mitigation approaches, including barrier methods, practice modifications, and virtual visits. A registry of dental practitioners has also been launched to investigate crucial safety issues associated with dental practices. A timely study on dentists' willingness and readiness to provide or facilitate coronavirus vaccine delivery during dental office visits, and patients' acceptance of dentist-delivered vaccines is also supported. Several research supplements have been awarded, including studies that examine oral mouthrinses, the effects of COVID-19 on oral-systemic health conditions, and the role of host and oral microbial factors in modulating the engagement of SARS-CoV-2 and angiotensin converting enzyme 2 for viral entry. A full list with details can be found at the NIDCR web page Rapid Funding for COVID-19 Research in 2020.⁵

At the trans-NIH level, the Rapid Acceleration of Diagnostics (RADx)⁶ initiative receives substantial investments for speeding innovation in the development, commercialization, and implementation of technologies for COVID-19 testing, with an emphasis on reaching underserved and vulnerable populations. Under the RADx Radical⁷ program, 1 of 4 RADx programs, NIDCR along with sister institutes identified 2 high priority research domains for funding: "Novel Biosensing for Screening, Diagnosis and Monitoring of COVID-19 From Skin and the Oral Cavity" and

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“Chemosensory Testing as a COVID-19 Screening Tool.” These funding opportunities resulted in several product development projects, with some conducted in the small business community, and include studies developing a colorimetric sensing “smart mask”: novel biosensors for SARS-CoV-2 using saliva—and exhaled breath condensates—as a diagnostic biofluid. A list with details can be found at NIDCR-Supported RADx Awards⁸ and in the complete list of RADx-funded projects.⁹

Pursuing these seed grant opportunities in 2020 and sharpening the focus to address remaining knowledge gaps by capturing emerging research opportunities, NIDCR also developed a new, broad initiative to further COVID-19 research.¹⁰ The overall goals are to encourage research that would inform prevention, detection, diagnosis, and treatment of COVID-19 and COVID-19–related illnesses as well as stimulate innovations in health surveillance and care delivery in an era of the COVID-19 pandemic, within the mission of NIDCR. The first NOSI that arose from this initiative calls for research focused on the physiological involvement of oral cavity and oral manifestations related to SARS-CoV-2 and COVID-19, including alterations to the oral-gut microbiota axis, oral mucosal immunity, oral biomolecular signatures, oral biosensing, and long-term outcomes. Future opportunities could support research on techniques to minimize aerosolization during dental procedures, nonaerosolizing procedures, and use of digital and virtual health tools as well as the consequences of deferred dental care and the negative impact on dental practitioners. Outcomes from this initiative are expected to strengthen the knowledge base of COVID-19 disease mechanisms and presentations in the oral cavity, expand the spectrum of SARS-CoV-2 detection and COVID-19 diagnosis, transform the practice of craniofacial, dental, and oral health care to protect practitioners and their patients, and close the gap in oral health disparities and inequities through personalized risk assessment and technologies. Long-term, biomedical, and behavioral interventions to combat COVID-19 and COVID-19–related illness, as well as technologies for detecting and diagnosing the disease, and mitigating spread, could be mobilized, and adapted to manage the next pandemic.

With an infusion of funds, NIH launched a new initiative to study Post-Acute Sequelae of SARS-CoV-2 infection¹¹ (PASC), also known as “long COVID”, to address gaps in our understanding of persistent symptoms associated with COVID-19. A SARS-CoV-2 Recovery Cohort, along with Core Resources will be assembled to support research on characterizing the epidemiology of PASC and the spectrum of symptom presentation, identifying biological underpinnings and risk factors for PASC, and comorbid conditions, to inform prevention and treatment. This key initiative is aligned with the NIH-wide Strategic Plan for COVID-19 Research.¹²

CONCLUSIONS

In keeping with the urgency of the COVID-19 pandemic, NIDCR is committed to the timely dissemination of new findings to the scientific and educational communities, as well as to professional organizations and patient advocacy groups. In addition to providing us with valuable lessons about ways in which we can prepare and respond to future viral outbreaks, the pandemic has brought the best minds in science together to create new preventative, diagnostic, and therapeutic technologies that can potentially be translated for future use in other conditions that affect the dental, oral, and craniofacial complex. ■

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