

From Cells to Communities:

Addressing COVID-19 in Delaware Through Scientific Research

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“Ingenuity, knowledge, and organization alter but cannot cancel humanity's vulnerability to invasion by parasitic forms of life. Infectious disease which antedated the emergence of humankind will last as long as humanity itself, and will surely remain, as it has been hitherto, one of the fundamental parameters and determinants of human history.” - William H. McNeill, in *Plagues and Peoples*, 1976¹

In December of 2019, reports of an outbreak of a new pneumonia-like virus originated from Wuhan, China.² The identified infectious agent, a novel coronavirus, known as SARS-CoV-2, spread rapidly and by mid-January cases were identified beyond China in Japan, Thailand, and South Korea.³ The first case in the United States occurred in a man in his 30s who resided in Washington State and was diagnosed on January 21, 2020.⁴ By the end of the month, the World Health Organization declared the outbreak a global public health emergency with 9,000 cases worldwide.⁵ Over the next two months, we witnessed the destabilization of the world economic markets and watched in disbelief as overrun hospitals and soaring death rates in Italy, Spain, and New York City became warning sentinels for the rest of the world.

SARS-CoV-2 causes a respiratory illness we now commonly refer to as COVID-19.⁶ In the seven months since the first case reports, the world has been engulfed in a pandemic totaling over 10 million confirmed cases and 500,000 deaths with 2.65 million cases and 125,000 deaths in the United States as of June 21, 2020.⁷ Although some countries have successfully slowed the rate of transmission through public health practices, other countries, such as Brazil and the United States, are continuing to report new case rates that are rising exponentially.

To understand the challenges the United States has faced in dealing with this pandemic, we need to look to the past. As early as the 1990s, the Centers for Disease Control and Prevention (CDC) as well as many other public health professionals had argued for strengthening the public health infrastructures of our nation in order to protect against novel infectious diseases.⁸ Central to the strategy of prevention is the concept that it is less costly to anticipate and prevent infectious disease threats than to react to widespread illnesses with expensive treatment and radical containment measures. Unfortunately, in the years prior to the COVID-19 pandemic, the United States has de-funded its public health infrastructure and missed opportunities to anticipate infectious disease threats.⁹ We are now reacting to this pandemic after repeated underinvestment in essential prevention activities including surveillance, laboratory research and training, epidemiologic investigation, and infection control efforts. This has resulted in both human suffering and widespread economic losses over the past six months that are many times greater than the savings accrued by budget cuts.

Without a coordinated national response to provide guidance on a plan to halt the spread of this disease, local city, county, and state governmental agencies, as well as businesses and organizations, have been developing and implementing independent mitigation efforts. This piecemeal response to the pandemic has broadly resulted in uneven assistance to states, funding

and supply delays for healthcare providers, inconsistent public health messaging, and insufficient testing capabilities.¹⁰ It has also resulted in the continued spread of this disease throughout the United States despite the closure of schools and businesses throughout March and April.

In Delaware, the first case of COVID-19 was identified on March 11, 2020.¹¹ Prior to that first case, Delaware state and local government agencies, its healthcare systems, and our academic and technology and research partners had begun preparing for the outbreak. Having watched the toll this virus was taking on our neighbors in New York, New Jersey, and Pennsylvania, swift action by the Governor led to the transition of all schools to virtual learning platforms as well as a general shelter in place order within days after the first case was announced. In addition to the swift action of our state and local government agencies, the scientific, healthcare and business institutions of Delaware came together to develop strategies that allowed for a deeper understanding of the potential impact of COVID-19 on our community in order to develop efforts to mitigate the devastating effects of this disease. As just one example of these efforts, ChristianaCare established a drive through testing site less than 24 hours from the first diagnosed case.¹² Since then, additional healthcare systems along with the Delaware Division of Public Health and New Castle County government have expanded diagnostic testing.¹³

In this edition of the Delaware Journal of Public Health, we have gathered a collection of innovative science occurring throughout our State as we all continue to flatten the curve. We provide a view of public health and medical activities across the continuum of clinical and translational research led by Delaware scientists. Over the past decade, several large research infrastructure programs such as the Idea Network for Biomedical Research Excellence (INBRE) and ACCEL: Delaware Center for Translational Research (DE-CTR) programs have worked to establish a network of education, healthcare, business, technology, research, and public health partners. These partners are a catalyst for connecting various research practices to improve the health of all Delawareans. Investments in this network have allowed for multidisciplinary teams to quickly come together in the face of this pandemic in order to understand disease dynamics, improve diagnosis and treatment, care for the caregivers on the frontlines, and contribute to technological advances that enhance prevention and treatment of COVID-19.

The overwhelming response to our call for COVID-19 related research necessitated two volumes of the current edition. In volume 1, we start on the bench by providing insight into the virus itself. The first series of articles describe work to understand the basic virology of this novel virus and to develop methods to enhance diagnostic testing through laboratory-based methods, serology tests, and molecular diagnostics. The next group of articles move to the bedside, highlighting the importance of developing novel treatments and therapeutics for COVID-19, testing the efficacy of existing pharmaceuticals through rapidly implemented clinical trials, and describing the need for clinical care to address important subpopulations including children, persons with mental health issues, and those with substance abuse use disorders. We then move to public health, and deal with the science of protecting and improving the health of the community. As a science, public health operates in the background of our everyday lives; it is only when disaster strikes that we realize its importance for keeping our communities healthy and safe from harm. In this section, you will read about local research on COVID-19 surveillance, contact tracing, and testing activities.

Finally, our healthcare and prevention efforts must focus on the most vulnerable amongst us. Early data from across the nation, including Delaware, has brought a voice to the members of medically underserved communities who are also disproportionately more likely to contract

COVID-19.¹⁴ We have gathered several examples of the focused efforts occurring throughout the State to examine the impact of the social determinants of health, racial injustice, and homelessness that cause greater divides in the health equity of our communities. You will read about research and actions addressing those disparities through community engagement and frontline social first responders.

Volume 2 starts with our frontline healthcare workers. We bring you several articles describing first-hand the experience of the front-line health care workers who have been addressing this pandemic. We focus on their emotional resources and well-being and provide an editorial on the need for humility in practice and in research. In volume 2, you will also read about innovative technologies being manufactured right here in Delaware that expand the supply of personal protective equipment and engineer solutions for resource optimization.

In the United States, an anti-science sentiment has been increasing over the past several years.¹⁵ COVID-19 has reminded us of the importance of scientifically based health research and practice. Science is our guide to navigate our way out of the havoc created by this devastating virus. Health professionals will continue to work intensely across the State of Delaware and throughout the nation to understand COVID-19 in order to protect the health of the population and minimize the negative impact of this and future diseases. And the rate at which we recover will be directly impacted by the universal empathetic concern we have for each other. Delaware has benefited from the strong commitment of its leaders in government, healthcare, education, business, and technology to improve lives through science and research. These efforts have established a medical and public health network that has come together toward one common human goal: our continued ability to protect and improve the health of the individuals in our community.

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