NLM's Contribution to the COVID-19 Response: Innovation and Action

The National Library of Medicine (NLM) advances science and medicine by driving discovery through research and the exchange of information to improve public health. As a global leader in biomedical informatics and computational health data science research and a steward of information services, NLM enabled a swift, nimble response to the COVID-19 pandemic with innovations that position it to support responses to future threats to public health.

NLM leveraged its trusted relationships with partners and robust technological infrastructure to ensure the availability of data, information, and research essential to response efforts. Among other accomplishments, NLM:

- Expedited acquisition, access, and use of SARS-CoV-2 **sequence data** through NLM's publicly available genetic databases. When the World Health Organization (WHO) declared coronavirus disease 2019 (COVID-19) a pandemic on March 11, 2020, NLM had already acquired, curated, and released the first fully annotated severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) gene sequence to the public on January 15, 2020. NLM's Sequence Read Archive, or SRA, the world's largest publicly available repository of high-throughput genetic sequencing data, now contains more than 3 million SARS-CoV-2–related sequences

- Leveraged its ClinicalTrials.gov registry and results database to provide comprehensive access to information about COVID-19 **clinical studies** worldwide, including those registered with the WHO's International Clinical Trial Registry Platform. ClinicalTrials.gov now lists more than 7,500 registered COVID-19 clinical trials.

- Partnered with the White House, private-sector partners, and more than 50 publishers to ensure immediate availability of *all* **their published journal literature** on COVID-19 and related coronaviruses through its PubMed Central (PMC) digital archive of life-science literature. An initial collection of 29,000 articles has grown to more than 285,000 COVID-19 articles that are freely available in machine-readable forms to support computational analysis. This collection of coronavirus-related information enabled artificial intelligence and machine learning researchers to accelerate discoveries about COVID-19.

- Launched the National Institutes of Health (NIH) **Preprint** Pilot, to provide accelerated access to the results of NIH-supported SARS-CoV-2 and COVID-19 research by making prepublication (preprint) versions of articles available through PubMed Central (PMC) and PubMed. More than 3,000 such preprints are now available through PMC, where they have been viewed more than 3 million times.

- Enhanced understanding of a novel virus and its impact on human health through **computational research**. Investigators in NLM's intramural and extramural research programs pivoted to address the COVID-19 public health challenge with sophisticated biomedical informatics and computational biology methods. For example, a collaboration between NLM's intramural research program and scientists in the community resulted in computational models for wastewater surveillance for early detection of SARS-CoV-2 that now serves as the precursor to new approaches to infectious disease surveillance.

Now, in the third year of the pandemic, NLM continues to build on its technological infrastructure and partnerships with the broader NIH community, other Federal agencies, including the Centers for Disease Control and Prevention (CDC) and Centers for Medicare & Medicaid Services, and the global scientific community in accelerating the development of vaccines and therapeutic targets and making relevant clinical trial information readily available. NLM shares its technical expertise with major NIH, government-wide, and global pandemic-related initiatives.

Supporting a Data-Driven Public Health Response

COVID-19 is the first pandemic where our nation's response has been led by data and supported by information. NLM resources and repositories played an essential role, making complex genomic sequences available to scientists and clinical information and guidelines available for doctors and nurses. NLM provided up-to-the- minute advice on testing, vaccines, and mitigation for communities, schools, and families. In this role, NLM participates in cross-government efforts to ensure a data-driven response and prepare for future public health threats:

- NLM's participation in NIH's Accelerating COVID-19 Therapeutic Interventions and Vaccines (ACTIV) Tracking Resistance and Coronavirus Evolution (TRACE) initiative includes the development of novel data processes and analysis methodologies to support weekly tracking of the frequency of SARS-CoV-2 sequence mutations and variants, including predictions about variants that may have an impact on therapeutics.
- NLM's assistance in the CDC-led SARS-CoV-2 Sequencing for Public Health Emergency Response, Epidemiology and Surveillance (SPHERES) consortium facilitates data submissions and ensures that information provided by sequence submitters is sufficient to support public health data analyses. NLM's expertise also addresses potential data quality issues and drives conversations about improving the quality and interpretation of data.

These activities ensure rapid dissemination and maximum impact of these data and information worldwide.

A Trusted Resource for Stakeholders and Communities
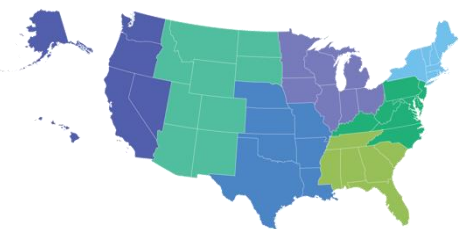
7 Regions of the NLM-Supported Network of the National Library of Medicine

NLM is a trusted source of COVID-19 data and information for everyone, from researchers and public health experts to clinicians and the general public. Through the more than 8,000 organizational members of the Network of the National Library of Medicine (NNLM), 60% of which support underserved communities, NLM helps community leaders and the public find timely, accurate, science-based COVID-19 information. NNLM facilitated community-based engagement in key NIH COVID-19 initiatives, such as the Rapid Acceleration of Diagnostics (RADx) program and the Community Engagement Alliance (CEAL) Against COVID-19.

Commitment to the Future

NLM is proud to be an essential part of the U.S. response to the COVID-19 pandemic. NLM envisions a future in which genomic sequence analysis becomes a foundational tool in public health surveillance. NLM's preeminence in scientific communication will open the future to new modes of sharing research findings, data, and clinical information through continued innovation that supports the rapid dissemination of science in the service of public health.