The COVID-19 Dashboard for Real-time Tracking of the Pandemic
The Lasker-Bloomberg Public Service Award

The 2022 Lasker-Bloomberg Public Service Award has been presented to Lauren Gardner, PhD, for creating the COVID-19 Dashboard, which set a new standard for disseminating authoritative public health data in real time.

COVID-19 is not the first and will not be the last pandemic of the 21st century. Around the globe, novel interactions among people, animals, and the environment are increasing due to an expanded population, shifting land use practices (eg, deforestation), and climate change. These changes have led to more frequent and closer contacts between humans and animals, providing more opportunities for disease to pass between animals and humans. Simultaneously, more frequent travel and trade increase the risk that spillover events result in wider spread of infectious disease outbreaks, epidemics, or even pandemics.

This growing risk is evidenced by the increasing number of public health emergencies of international concern (PHEIC) declared by the World Health Organization: since the International Health Regulations (IHR) came into force in 2007, 14 PHEICs have been declared, 2 of which are concurrently ongoing (the COVID-19 pandemic and the 2022 monkeypox outbreak). As these trends continue, systems that enable identification of and timely and effective response to these events are critical. At their core, these systems rely on the provision of timely, accurate, and accessible public health data. In turn, these data enable modeling, analysis, and evidence-based public health policy to mitigate risks, reduce harm, and save lives.

Historically, emerging infectious disease outbreaks have been characterized by a lack of high-quality public health data, especially at the early stages of an outbreak. The clear need for this information was the motivation behind the creation of the Johns Hopkins University (JHU) COVID-19 Dashboard, which provides a centralized, real-time reporting and open data sharing system.2 The initial prototype of the Dashboard and data set was shared publicly on January 22, 2020, when only 548 cases of (what would later be defined as) COVID-19 had been reported in China and 9 cases reported outside of China.3 The demand for accessible and timely public health data was immediately evident; within a week of being launched, the Dashboard received more than 1 million hits (ie, requests for information from the site) per day. Six weeks later, that number exceeded 1 billion. Today, the Dashboard reports comprehensive COVID-19 statistics including reported cases, reported deaths, and vaccine administrations for more than 3500 locations ranging from county to country level, representing nearly every country in the world, and is updated on an hourly basis.4 To date, the Dashboard has received more than 226 billion information requests and 3.6 billion page views from an international user base.2

The COVID-19 Dashboard for real-time tracking of the pandemic and the corresponding data set were initially intended as a resource for the academic community but ended up serving as a critical resource for a broad set of public health officials, the media, and the general public. Research groups, often in collaboration with public health policy makers, have relied on the data for prospective and retrospective COVID-19 modeling and analysis, evidenced by the more than 8500 citations collected on the related publication in 2 years.3 For example, the COVID-19 Forecast Hub, which "maintains the authoritative, up-to-date record for forecasts of COVID-19 cases, deaths and hospitalizations in the US, created by dozens of leading infectious disease modeling teams from around the globe, in coordination with the US CDC,"5 relies on the JHU data for both model development and evaluation.6,7

Beyond the research community, the Dashboard has been relied on by all levels of government and commercial entities in multiple countries, states/provinces, and cities around the world for informing COVID-19 response. As examples, the US Centers for Disease Control and Prevention (CDC), Department of Health and Human Services, and Federal Emergency Management Agency used the JHU data to guide US policy. Johnson & Johnson relied on the data to determine where best to hold vaccine trials, and Ford Motor Company used the data to determine which factories and offices to keep operational and to time the reopening of others. In addition to supporting research and policy, the Dashboard has served as a mechanism for public awareness of the pandemic in real time through interactive...
visualization and use of the underlying data by major media and related organizations worldwide, including the New York Times, Our World in Data, CNN, NPR, the Wall Street Journal, Google, and others. The broad direct and indirect dissemination of the data to the public enabled individuals to make informed behavioral choices in response to data and facts at a time when misinformation was rampant, and the traditionally relied-upon governmental institutions were unable to adequately provide the information demanded by the general public. This access to information was especially critical due to the politicization of this public health crisis, whereby risk mitigation policies were often implemented too late, removed too early, or, in many locations, nonexistent, and individuals were left to make their own decisions to protect themselves.6

The overwhelming success of the Dashboard in terms of engagement revealed significant gaps in extant public health infrastructure, and the unique and critical role academic institutions can have in both serving the public during a global crisis and advancing the state of the art in public health practice. While governments have historically been the relied-upon sources for public health data, JHU’s leadership in this role during the COVID-19 pandemic can be attributed to multiple factors. The first is timeliness. The need for and value of timely and accessible public health data in the earliest stages of an outbreak was recognized as a means to improve the understanding of infectious disease risk and support evidence-based decision-making. The second is resourcefulness. Financial support for the Dashboard was provided from the institution within days of the Dashboard being launched, and shortly after by philanthropies, namely Bloomberg Philanthropies and the Stavros Niarchos Foundation. These contributions supported the project as its demand and scale grew exponentially and enabled it to remain an independent source for information.

The third is skill sets and staffing. The technical expertise and time required to maintain the Dashboard was substantial. Notably, the team supporting the Dashboard, including students and staff representing the JHU Center for Systems Science and Engineering, the JHU Applied Physics Laboratory, Johns Hopkins Sheridan Libraries, and Esri, is highly interdisciplinary, with critical expertise in systems engineering, software development, data science, and data visualization. These skill sets require further investment and should exist as standing capabilities within public health agencies.

The fourth factor that contributed to the success of the Dashboard is academic freedom. The environment in which data collection was occurring was messy and complicated, especially in the early crucial days and weeks when the global situation was changing hourly. As members of an academic institution, the faculty and staff involved with the Dashboard were able to quickly make decisions on how to handle data collection, processing, and reporting issues in real time, and they had the autonomy to act.

Moving forward will require learning from these past experiences, both successes and failures, to build an effective and robust system for responding to public health emergencies.9 Central to this effort is the reliance on publicly available data. Future efforts to provide an aggregate, timely open data set on a public health crisis would greatly benefit from a standardized reporting system; this includes clearly defined (consistent) data structures, with data provided in machine-readable formats, well-defined parameters, and health outcomes disaggregated by sociodemographic characteristics and at actionable spatial and temporal resolutions. These capabilities need to apply to the broadest possible set of infectious disease threats. Doing these things will both help all involved make sound and timely decisions when the next potential outbreak occurs and help establish the public trust necessary to counteract health-related disinformation.

The COVID-19 Dashboard for real-time tracking of the pandemic filled a major void in international public health systems and changed the expectations around access to high-quality real-time public health information. Since its creation, it has evolved into the leading authoritative source of centralized data on the pandemic, allowing governments, media, and the public to understand and address its rapid spread. The dashboard concept has been widely replicated around the world by domestic and foreign governments, media outlets, private enterprises, and higher education institutions. An international network of related dashboards is expected to become a permanent fixture in how nations improve coordinated responses to future pandemics and epidemics. Finally, the data set underlying the visualization will serve as an invaluable resource for retrospective scientific analysis of COVID-19, enabling a better understanding of infectious disease transmission and preparation for future pandemics.

ARTICLE INFORMATION
Published Online: September 28, 2022.
doi:10.1001/jama.2022.15590

Conflict of Interest Disclosures: Dr Gardner reported that the COVID-19 Dashboard received funding from Bloomberg Philanthropies, the Stavros Niarchos Foundation, and the National Science Foundation.

REFERENCES