Preprint

Dashboards and Public Health: The Development, Impacts, and Lessons From the Irish Government COVID-19 Dashboards

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Dashboards use a suite of visual analytics, such as various forms of graphs (e.g., line graphs, histograms, bar charts, pie charts), maps, and infographics (e.g., gauges, traffic lights, meters, arrows) to display and communicate time series and spatial data.[1] Most contemporary dashboards are dynamic (i.e., being updated as data, including real-time data, are released) and interactive (e.g., allowing selecting, filtering, and querying data; zooming in or out, panning, and overlaying; changing type of visualization).[2] The power and utility of dashboards is that they act as effective cognitive tools for making sense of and tracking voluminous, varied, and quickly transitioning data, enabling users to examine emerging patterns and trends and make evidence-informed decisions and policy responses.[3,4] Consequently, dashboards have become common across sectors as a means to communicate, monitor, track, analyze, and act on large volumes of dynamic data.

In the case of health, dashboards have been developed for a variety of purposes, ranging from monitoring individual patient diagnostics (e.g., the dashboard of an intensive care unit monitor)

or wellness (e.g., the dashboard of a fitness app), to the management of a hospital (e.g., the performance of staff teams and services benchmarked against targets and other hospitals), to the tracking of disease outbreaks within and across jurisdictions.[4–6] As the COVID-19 pandemic started to become a global phenomenon, a number of COVID-19 dashboards were developed that displayed time series, key performance indicators at different spatial scales (e.g., countries, regions, local areas, hospitals).[7–9]

Academics, journalists, citizen scientists, and health professionals created a number of these dashboards using open data sets as a means of publicly communicating the unfolding situation. Governments and health agencies developed other COVID-19 dashboards to monitor and direct public health operations and formulate policy, as well to communicate with populations. We discuss the development of the official Irish government COVID-19 dashboards (one designed for the public, the other for internal use only), tracing their development and impact as well as lessons to be learned from their development. Our analysis is based on being actively involved with the dashboards in their proposal, design, implementation, and ongoing maintenance.

Development

The first case of COVID-19 was detected in Ireland on February 29, 2020. The government quickly put in place the National Public Health Emergency Team (NPHET) to be responsible for monitoring and tackling COVID-19, including formulating and implementing policy related to health system responses (e.g., hospital practices, testing regime, and contact tracing) and citizen and society behavior (hygiene, social distancing, mask wearing, lockdowns, etc.). Data related to the disease quickly became an issue for the government, the media, and the public.

On March 12, the All-Island Research Observatory, in collaboration with colleagues at Ordnance Survey Ireland (OSI) and the Central Statistics Office (CSO), proposed the creation of a public-facing Irish COVID-19 dashboard to the Department of Health, using the Johns Hopkins Coronavirus Resource Center dashboard, which was launched on January 22, 2020,[9,10] as a case example. Following a short demonstration and sharing of a basic prototype, the proposal was favorably received, in large part because the All-Island Research Observatory already had a long-established strategic partnership with OSI to develop and manage government-related dashboards and mapping toolkits using the GeoHive platform. In addition, OSI and the CSO had an ongoing collaborative relationship, with governance and technical agreements in place for the recently developed UN Sustainable Development Goals Hub for Ireland. Shared experience from this collaboration provided critical direction in the initial development of the COVID-19 dashboard and future iterations.

On March 17, 2020, the OSI and CSO established the COVID-19 Response Coordination Group, and the Department of Health agreed to commission a COVID-19 dashboard using the GeoHive platform. Crucially, the work was to be underpinned by a formal memorandum of understanding between the All-Island Research Observatory, the CSO, and OSI; a service-level agreement between OSI and the Department of Housing, Planning and Local Government; a framework agreement between OSI and Esri Ireland (which provided the Operations Dashboard for ArcGIS software and technical support); and collaborative arrangements with the Department of Health, the Health Protection Surveillance Centre at the Health Service Executive, and the Office of the Government Chief Information Officer.

The purpose of the Response Coordination Group was to coordinate the technical, data, policy, and financial activities associated with producing a geospatial data hub and dashboard to

inform Ireland's response to the COVID-19 outbreak. The underpinning logic of the data strategy was to "collect once, use many times," with the data not only feeding into the dashboard but also available for other activities such as modeling, planning, policy, and operational work. Key aspects of the initial work were to create a workflow and governance model for sourcing and managing data, building and maintaining the data infrastructure, and designing and creating the dashboard. The assistance of the Central Statistics Office Administrative Data Centre was central to this process, as it provided a secure data infrastructure and researcher data portal to support this work.

Work proceeded rapidly, with the COVID-19 Health Surveillance Monitor dashboard publicly launched on March 24, 2020. The dashboard provided information on confirmed cases, deaths, and modes of transmission; segmentation by age, gender, and county; and international benchmarking. This public dashboard was migrated to an ArcGIS Hub platform in June 2020, and new data and tools continued to be added for the next 18 months, along with a Frequently Asked Questions section. This ongoing development was informed and steered through weekly COVID-19 data coordination group meetings chaired by the Department of Health. The development included those involved in COVID-19 data collection and dissemination as well as technical experts from the Health Services Executive, the Central Statistics Office, the National Office of Clinical Audit, OSI, the All-Island Research Observatory, and the Departments of Health and Public Expenditure and Reform. The original dashboards and hubs, as well as all open-data services, proved very popular, with more than 250 million views in 2020 and 2021 (the Irish population is 5 million).

After the launch of the public dashboard, attention turned to developing an internal, centralized, and secure National Public Health Emergency Team COVID-19 data hub to provide

far more in-depth analysis for key stakeholders and to include case data, computerized infectious disease records, acute and intensive care unit hospital data, laboratory testing, movement data from telecoms, and, later, vaccination data. New partnerships were formed with the National Office of Clinical Audit, Health Atlas Ireland, and the University College Dublin National Virus Reference Laboratory. The tools developed provided highly detailed time series and spatial views of COVID-19, its impact on society at the electoral division area (typically ~5000 households), and the health services response with information on individual units in specific hospitals. The Statistics Act (1993) provided the legal framework for sharing such microdata. The secure data hub also had a sandbox section for exploring new dashboard tools and exploring pressing research questions. Access to the dashboard was strictly restricted to 140 registered users from key bodies. Some of the new data and tools were added to the public dashboard in an aggregated and de-identified form to protect privacy and confidentiality and to comply with General Data Protection Regulation.

The final element of the dashboard work was to make the data used in the public dashboard available on the Irish government open-data site, data.gov.ie, enabling other interested parties to examine the data, build their own data tools, and offer their own analyses. Much of these self-produced data analytics were circulated on social media and traditional media, but, importantly, they used the same official data, reducing confusion concerning data sources and veracity. The COVID-19 Daily Statistics for Ireland by County data set is now the most downloaded data set on the site.

Impact and Lessons

The public and internal Response Coordination Group–produced COVID-19 dashboards had important impacts with respect to how the pandemic was handled in Ireland. The dashboards provided vital, timely, fine-grained intelligence on a rapidly unfolding situation that directly shaped operational decision making and policy formulation, locally and nationally, and informed public opinion about and attitudes toward the disease and public health measures. The data became a key means of justifying to the public difficult and unpopular decisions concerning lockdowns and public health responses, such as mask wearing. Indeed, the public dashboard and its key indicator data were a daily feature of traditional media reporting and public debate on radio, television, and social media. Internally, the dashboard was a key resource for modeling and near and midterm operational planning of resources and responses. An important impact was to rapidly transform elements of the health data ecosystem in Ireland; long-standing data silos and institutional inertia were dismantled and rebuilt in a handful of weeks, with new data infrastructures, data practices, data protocols, data sharing, and publishing arrangements put in place.

The pandemic and its quickly unfolding nature were clearly the impetus for the rapid changes in the health data ecosystem, but these changes could not have occurred as effectively as they did without a number of conditions. The initiative used existing, successful working relationships between key stakeholders and a body of expertise for building geospatial dashboards. This relationship had already established the legal basis for cooperation and data governance and had a demonstrated and trusted record of delivering high-quality, secure, and trusted data infrastructures and tools. In other words, building on existing relationships and platforms, where trust, systems, roles, and leadership are already in place, enabled a more effective and timely

response than starting from scratch. These preexisting relationships—along with the political backing and prioritization by the leading figures in the National Public Health Emergency Team—short-circuited early debate, data protectionism, and potential division between, or resistance by, stakeholders and provided a somewhat ready-made path toward the constitution of a data hub and dashboards.

"Can-do" leadership, where the priority was to make things happen and quickly, was vital. The data governance arrangements were especially important in instilling confidence among all participating parties regarding data security, legal compliance with General Data Protection Regulation, and the appropriate use of the data. Another important decision was to make the data openly available, where legally possible, enabling others to verify, replicate, reproduce, and contribute ideas. This helped to facilitate an evidence-informed public narrative on COVID-19 and established a culture of having to back up claims with data, rather than a political–ideological narrative dominating.

The COVID-19 data hub and dashboards produced in Ireland are significant elements that have informed the public health response to the disease. Importantly, how they were implemented seems set to produce three longer-term impacts. First, it has set in motion a transformation of Ireland's health data ecosystem. Second, it has helped to cement an evidence-informed approach to dealing with an unfolding crisis and to monitoring public health in Ireland. Third, it has established the use of dashboard tools for public and media reporting and an expectation for evidence-informed public debate and the availability of open data. Therefore, we anticipate that public dashboards will become increasingly common for guiding internal operations and for public communication.

Dashboard and Associated Data

The Irish COVID-19 dashboard is available at https://covid19ireland-geohive.hub.arcgis.com. All of the publicly available COVID-19 data related to Ireland, plus associated information and links to international data, are available at https://data.gov.ie/blog/coronavirus-covid-19.

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Conflicts of Interest

The authors have no conflicts of interest to disclose.

Human Participation Protection

The dashboards were a direct government intervention in tackling COVID-19, not a research project that would require institutional review board approval. The work was directly overseen by several government departments and complied with General Data Protection Regulation requirements.

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