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Address COVID-19 Preparedness and Response in Your Public Health Data and Analytics Strategy

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18 March 2020

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Published 18 March 2020 - ID G00721739 - 21 min read

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Initiatives:Data and Analytics Leaders **and 1 more**

COVID-19 has caught public health organizations off guard. They are realizing that they lack sufficient data and insights to combat an epidemic before it spirals out of control. Data and analytics leaders must develop a comprehensive pandemic preparedness strategy using data and modern technology.

Overview

Impacts

- Disease outbreaks and health crises are becoming more frequent due to our increased global connectedness. Public healthcare organizations without an effective data and analytics (D&A) strategy that addresses pandemic preparedness and response will lack the data and potentially lifesaving insights necessary to minimize these crises.
- Public healthcare organizations must have critical data and analytics capabilities and effective mechanisms to coordinate with other agencies, the private sector and international partners. This will be necessary to effectively detect early outbreak signs, generate warnings in time, and disseminate information to stakeholders (including disease surveillance information).
- Intelligent health command platforms should be at the core of disease surveillance operations. However, for public health and healthcare organizations, a comprehensive off-the-shelf answer is difficult to find.

Recommendations

Data and analytics leaders responsible for public health and healthcare should:

- Triage data and analytics strategies and develop one for the longer term. Design a goal-oriented strategy and technology roadmap to help predict, prevent, detect, respond to and manage disease outbreaks.
- Build a catalog of existing technologies and data sources. Engage and learn from public, private and academic partnerships that are advancing the use of analytics, artificial intelligence (AI), automation and data science for disease prevention.

- Establish an intelligent health platform for emergency operational management during and after a crisis. Build an integrated model of person-centric health data combined with population health surveillance focused on early case detection, tracking and warning systems.

Analysis

The COVID-19 outbreak (see Note 1) has shown that most countries and organizations are ill prepared for an epidemic — and the world is not prepared for a pandemic. [1] Given the increased interconnectedness of the world, modern data and analytics technologies are essential and underutilized tools in fighting these crises. Data and analytics leaders need a modernized technology environment and a skilled workforce. These resources are invaluable in predicting, detecting, tracking, responding to and managing an epidemic or pandemic in near real time. Data and analytics is vital to early outbreak detection and response — allowing warnings to be sounded and the spread of disease to be halted. For this to become reality, data and analytics leaders responsible for health systems in the public sector must immediately develop a comprehensive intelligent health strategy. This strategy must take an integrated approach — delivering on the promise of new technologies and capitalizing on existing solutions.

Data and analytics technologies have enormous potential to transform disease monitoring, prevent and control cross-border transmission, and improve the timeliness of outbreak discovery, awareness and public engagement. The COVID-19 outbreak highlights the need for accurate and timely information at the community level, coupled with a high-level, coordinated ("all of government") approach, which spans all levels (that is, local, regional, national and global).

There is a window of opportunity in which an epidemic can be contained and accurate data and decision making are vital. This inflection point requires adaptive data and analytics governance, and procedures for early outbreak detection that generate accepted, actionable information. Near-real-time data and analytics can aid in the planning of health resources and in the attempts to flatten the curve before health system capacity is exceeded. A pandemic response takes on a life of its own with many additional dimensions — such as coordination, real-time data sharing within and across borders, and predictive scenarios with unpredictable timelines. Those without the means to see the data on testing, tracking and treatment are taking risks at a time of great uncertainty.

Numerous countries, states, provinces and territories have implemented mandatory notifiable disease reporting and integrated disease surveillance response (IDSR). However, most do not apply modern technology. They fail to address the challenges of an overburdened health system, and do not quickly incorporate information about new and emerging diseases. New capabilities are possible with advanced analytics. The ecosystem of data sources and event feeds can be expanded. It is possible to improve the timeliness, ease and quality of disease reporting and sharing of data. Systems can be opened providing multistakeholder or public access, but all too often these systems are not user-friendly, and they do not have feedback loops and visualization capabilities. They are locked down and the data is unavailable for use. This must change.

In a pandemic, it does not make sense to make a five-year plan. This is an immediate and time-pressing undertaking. Data and analytics leaders should develop game plans for:

- The short term — between now and three months' time
- The medium term — from three months to six months' time
- The longer term — from six months to a year and beyond

Figure 1 outlines the areas of impact and recommendations for data and analytics leaders.

Impact Appraisal for Data and Analytics Leaders

Impacts	Top Recommendations
Without effective strategy, public health and healthcare organizations lack valuable and potentially life-saving insights.	• Triage your strategy and develop a long-term, goal-oriented strategy to help predict, prevent, detect, respond to and manage disease outbreaks.
Public healthcare organizations lacking partner coordination will not effectively manage an epidemic.	• Build a catalog of existing technologies and data sources. Engage and learn from public, private and academic partnerships that are addressing disease prevention.
Intelligent health command platforms should be at the core of disease surveillance operations, but off-the-shelf answers are difficult to find.	• Establish an intelligent health platform for emergency operational management during and after a crisis. Build an integrated model of person-centric health data combined with population health surveillance.

Source: Gartner

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Figure 1: Impacts and Top Recommendations for Data and Analytics Leaders

Impacts and Recommendations

Without Effective Strategy, Public Health and Healthcare Organizations Lack Valuable and Potentially Lifesaving Insights

Epidemic threats are occurring with increasing scale, duration, and effect, often disrupting travel and trade, and damaging both national and regional economies. [1]

Many data and analytics leaders responsible for information systems in public-sector health and healthcare do not currently see epidemic and pandemic preparedness as part of their job. However, they must develop a strategy that includes targeted solutions that address use cases and work across the organization. Implementing a disease surveillance system without a well-coordinated data and analytics strategy will lead to response delays in healthcare, additional data silos and higher costs.

Data and analytics leaders must proactively drive that strategy to prevent, detect and respond to disease outbreaks, with emphasis on:

- The data architecture
- Pathways
- The speed at which information could and will likely travel
- Dissemination mechanisms
- Tools that facilitate remote care (telehealth) and rapid diagnosis
- End-user tools

Whether dealing with a current outbreak or planning for the future, data and analytics leaders (such as chief data officers [CDOs]) should prepare now. The next disease outbreak could be just around the corner. There are five steps that CDOs can take during an outbreak to actualize lifesaving visualization and data sharing (see Figure 2).

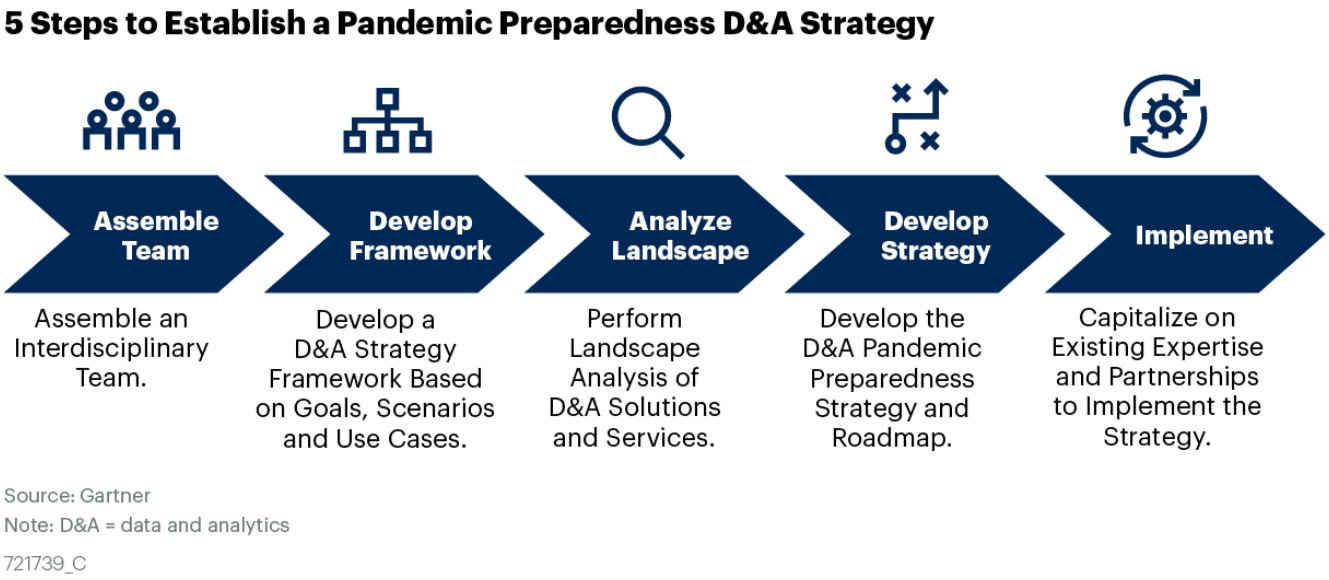

Figure 2: 5 Steps to Establish a Pandemic Preparedness D&A Strategy

During these five steps, data and analytics leaders must answer several questions and take effective actions. These include:

1. Assemble an interdisciplinary team — address the questions:
   - What are the scenarios and health concerns to address?
   - What are the most important health concerns? Which will have the highest impact?
   - Who are the actors and what are their roles in this?

- What D&A awareness mechanisms do we use/have now?

2. Develop a strategy framework — address the questions:
   - What are the principles and pillars of the strategy?
   - What technologies might be possible?
   - How can the use cases and scenarios map to technology?

3. Perform landscape analysis:
   - Catalog data assets. Include applications, lists, web and mobile services, data feeds and subscriptions.
   - Review resources for advanced analytics and dashboards. Include international, national and local credible sources.
   - Ensure up-to-date lists of resources, services, people and places.
   - Identify gaps, and the human resources needed for D&A actions and services including partners.
   - Categorize solutions and services and consider ordering.

4. Develop a strategy and roadmap — consider the following factors:
   - High impact collection and dissemination mechanisms should factor in heavily.
   - A centralized dashboard system with mobile access is an important feature.
   - Mechanisms that speed up data delivery are critically important and warrant prioritization.

5. Capitalize on existing expertise and partnerships to implement the strategy

In the near-term, triage your strategy by focusing on the identification and use of data sources and D&A technologies that will provide the highest impact on prevention, detection and response. This should take into account the context and the feasible time frame. Outbreak response requires a data and analytics platform that allows for discovery of the unexpected. It is the ability to discover and connect insights across various sources that allows the tracking and treatment of cases, and identification of outbreak trends and clusters.

Detection capabilities benefit from various types of surveillance, such as: [1]

- Public-health-event-based

- Indicator-based
- Syndromic (and event-based)
- One Health
- Sentinel

When choosing surveillance capabilities, data and analytics leaders must consider both the actions desired and the unintended consequences. Coordinating with other organizations that have established surveillance systems is paramount to accelerate your capabilities. The objective should be to quickly determine how surveillance can:

- Serve as an early outbreak warning system.
- Serve as a response system.
- Identify public health emergencies.
- Guide public health policy and strategies.
- Serve as a platform for a single source of information/truth.
- Document impact of an intervention, or progress toward specified public health targets or goals.
- Understand and monitor the epidemiology of a condition to set priorities and guide public health policy and strategies.

It is easy to get caught up in the challenges of incorporating disease-surveillance solutions, and many get stymied early on. Data and analytics leaders can overcome many common obstacles and barriers by applying the following guidance when applying technology to pandemic preparedness and response.

- Think through the value, objectives, use cases and overall feasibility before applying technology.
- Develop buy-in to your approach and the possible consequences before executing your plan.
- Include partners early to find a way forward — they may have solutions to apply.
- Identify and begin to address data-sharing policy issues and the lack of mechanisms for health information exchange. Evaluate factors such as incompleteness of data; data ownership and usage rights issues; data sources and services required; and required guidance from policymakers.
- Examine feasibility early on, since cost, maturity, geographic availability and other factors may eliminate a particular solution.

- Prioritize solutions that have minimal integration, interoperability and adoption challenges.
- Ensure adequate attention to training and data literacy issues.
- Avoid technologies that require extensive evaluations, pilots and implementation timelines that will delay the realization of benefits.
- Do not get bogged down by data standardization. The most important thing is to standardize only what is absolutely necessary.
- Develop memorandums of understanding between entities to manage expectations and enable data sharing.

Recommendations:

- Act immediately to triage your data and analytics strategy and incorporate epidemic and pandemic preparedness into a longer-term strategy. Design a goal-oriented strategy and technology roadmap to help predict, prevent, detect, respond to and manage disease outbreaks.
- Use scenario planning and other business practices to identify disease surveillance use cases and requirements. Create an “immediate outbreak” framework that addresses high-impact health and business goals.
- Decide the main goals and objectives of the surveillance, and which types of surveillance and data feeds to include in the strategy (for example, event-based, indicator-based, syndromic, zoonotic and mass notification services).
- Develop a catalog of existing technologies and data sources. Keep in mind that internet connectivity, web services, geospatial data and dashboard capabilities are the norm for near-real-time detection and response.
- Use trusted market information that has been vetted by the industry for your use-case scenarios. Look to maximize the value each offers. Consider an integrated approach.
- Assemble an interdisciplinary team and address the priority questions and goals for health that D&A should enable. Identify roles and responsibilities. Identify and engage partners.
- Establish your roadmap by ensuring your strategy and detailing activities, roles and responsibilities, and your workforce are all assigned to address the priority questions and goals for health that D&A should enable. Consider scenario planning.

Public Healthcare Organizations Lacking Partner Coordination Will Not Effectively Manage an Epidemic

Health organizations responsible for public health typically fall into three tiers (which are combinations of two categories of mandated health services):

- Tier 1: Population level only — responsible for monitoring the outbreak, public awareness and actions at the population level. Agencies responsible for population health should have strong monitoring capabilities and communication mechanisms for public awareness and feedback. They are often responsible for drafting policies, guidelines and putting into place practices (often through staff training) that are aimed at detecting, responding to, managing and, as best as possible, curtailing the outbreak. Data and mechanisms at this tier are communication systems, policy and guidance, and disease routine reporting that is mandated.
- Tier 2: Population and Patient levels — responsible for Tier 1 activities plus oversight of patient care at health facilities. These organizations and those reporting to them are responsible for detecting and responding to the outbreak with public awareness campaigns, patient care and treatment for those who are suspected to be ill. Examples of Tier 2 organizations include government agencies that oversee publicly funded hospitals/hospital systems (which may include clinics), and the health network for cities, states, provinces and countries. Another example is a university health center. Data mechanisms at this tier are for:
  - Patient tracking and management (such as electronic medical records [EMRs] and electronic health records [EHRs])
  - Health information exchange and data sharing
  - Testing information
  - Case-status reporting
  - Patient referrals and overall patient continuity of care
  - Mandated routine reporting
- Tier 3: Patient level and health facility level only — responsible for the care and treatment of patients. Data and mechanisms at this tier are electronic health records, patient summaries, routine disease reporting and health workforce information.

Outbreaks and new diseases test the capacity for governance and the effective management of people, process and technology. At the public health level, cities, states, provinces and countries face challenges with surveillance and outbreak response because of:

1. Fragmented data streams that do not enable easy access to raw data for timely analysis and data use.
2. A small workforce that is responsible for most surveillance and response-related activities.

3. Poor coordination during outbreaks resulting in slow response.

4. A sizable and complex set of stakeholders to interact and coordinate with.

5. Limited resources dedicated to public health. [4, 5]

Responding to a health emergency requires orchestrating the integration of resources across all three tiers of health services. Some public health systems have created governance structures with participation across all three tiers to mitigate these challenges. This has resulted in the establishment of public health emergency operating centers (PHEOCs) that serve as epidemic intelligence hubs. PHEOCs receive, analyze, and visualize multiple data streams, including surveillance data. PHEOCs are staffed with a trained workforce capable of analyzing and interpreting data in real time. These PHEOCs can be embedded within state-level or national-level health offices. Alternatively, they can be embedded in medical universities within the epidemiology or surveillance department (or an equivalent). This means that they do not necessarily exist as a stand-alone space, and they can operate continuously for routine health surveillance.

In the absence of a PHEOC, healthcare organizations must quickly form a task force to coordinate data collection, integration and usage with sister agencies, the private sector and international partners (PPPs). The immediate goal of this coordination is to determine the data, processes, technologies and practices that will provide essential and consistent information for consumption by all stakeholders, including the public. Existing information governance may need to change as a result of this coordination. Task forces include various types of resources, including epidemiologists, business analysts, visualization experts, data architects, data management personnel, business intelligence experts and data scientists.

Data collection from numerous sources may be needed based on the complexity of the situation and the size of the area served. Typically, data will be collected from an array of sources, including:

- Health workers
- Field staff
- Epidemiologists
- Call centers
- Hotlines
- Labs
- Sensors
- Indicator- and event-based sources
- Schools

- Social media
- Travel information
- Medical supply chains

Data linkages using APIs and seamless information exchange (such as health level seven [HL7] fast healthcare interoperability response [FHIR]) should be chosen over coded and manual processes. For patient data, identity management often presents a challenge. Health cards, RFIDs and biometrics streamline patient matching. Data management and integration with linkages to other sources can take time — but once they are set up, they should be fully automated. Assembling the required data requires clearing the way for data sharing, openness and innovation, while overcoming internal roadblocks — such as the heavy, compliance-oriented approaches that many governance programs employ, which limit the free flow of information.

It is critical to narrow the focus to priority use cases and scenarios based on desired outcomes, local context, regulations, constraints and overall feasibility.

Recommendations:

1. Activate (or establish) your organization's connection with the appropriate PHEOC.
2. In the absence of a connection to a relevant PHEOC, organizations should contact their parent health organization to see if one exists or is planned.
3. In the absence of a relevant PHEOC, establish an adaptive governance structure with a cross-functional team from sister agencies, the private sector and applicable international partners — that is, establish an emergency operations center (EOC).

Intelligent Health Command Platforms Should Be at the Core of Disease Surveillance Operations

Public health and healthcare organizations need to institute a modernized health command center that has a powerful visualization platform, and which incorporates incident- and crisis-management data and tools at its core. Pandemics overwhelm the health system and getting a realistic view of what is occurring can be difficult without a centralized approach in the style of a command center . The command center ideally will have advanced analytics capabilities and near-real-time data feeds containing population disease surveillance and patient data as well. The role of data and analytics leaders in the creation of pandemic digital platforms is mixed. There are those leaders who lead design and oversee implementation (including infrastructure procurement and data management) and those leaders who support the role that is responsible for platform aspects. It takes a coordinated effort to do the necessary.

Several large hospital networks in the U.S. and elsewhere have instituted this health command center concept for patient care response and monitoring. This concept includes the ability to vary

ongoing support and staffing levels based on the situation, and the possible application of telehealth. Some governments are utilizing a disease surveillance outbreak management system which functions primarily to aid the epidemiological response of case tracking and public health reporting for notifiable diseases. A model combining case-level outbreak tracking, patient monitoring and management, and population surveillance would provide a holistic view and be a very powerful platform for epidemic and pandemic response. Figure 3 outlines the constituent elements of an intelligent health platform.

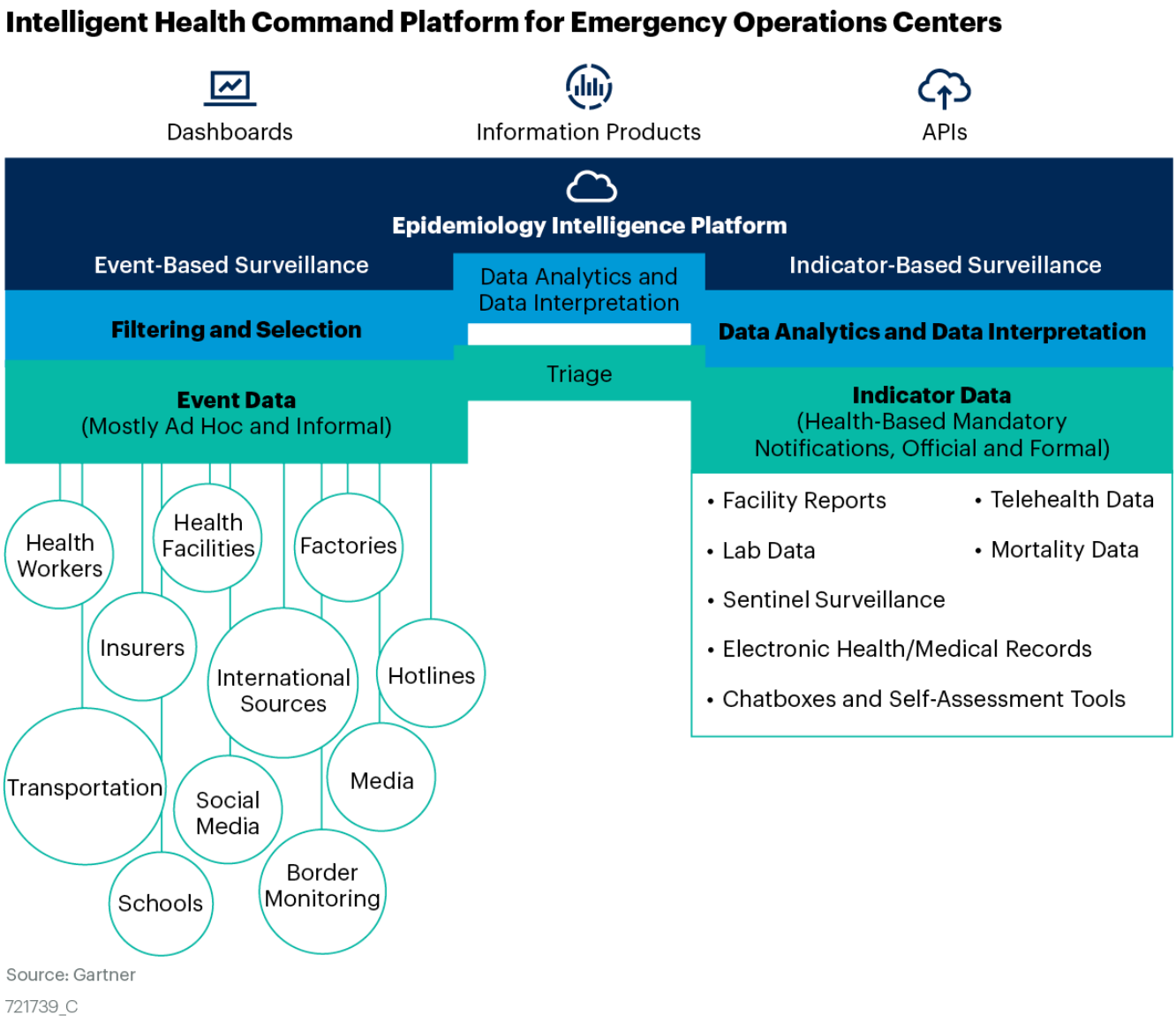

Figure 3: Intelligent Health Command Platform for Emergency Operations Centers

In this instance, intelligent health is defined as the application of historical and modern technologies combined with near real time population- and person-level data — allowing for the delivery of insightful information, predictions and suggestions that are contextually relevant and adaptive to user experiences.

To achieve this longer-term vision and establish a modernized intelligent health platform, public health and healthcare organizations should define the following:

- Data architecture
- Data sources
- Services
- Technologies for data acquisition and collection
- Enabling data standards and interoperability requirements
- Essential analytics
- Visualizations

To establish visibility across healthcare systems and understand healthcare use, this model could be expanded to include sources for providers, suppliers, payers, laboratories, and patient and population data (such as census data if available). This will aid in action, planning and forecasting of resources, particularly surges in demand for medical care and associated resources.

The types of surveillance needed will likely be different for each of the three tiers of public health services. Given the varied scopes of each tier, the organization's mandate will dictate the functional requirements and comprehensiveness of the command center, as well as its platform architecture and the D&A solutions that will be deployed. Establishing the appropriate data storage, connectivity and computing environments appropriate to the scope of the platform will require collaboration with other IT leaders, including those responsible for IT infrastructure. Decisions will also need to be made about data access policies and data sharing guidance.

The command center is a hybrid of modern and existing technologies — embedding intelligence in applications and unlocking the data in legacy systems in innovative ways. The goal is to combine local, event-based (and syndromic) data, indicator-based data, and internationally sourced data, such as feeds from third parties and new response systems (such as mobile apps, websites and interactive voice response hotlines). This will result in the creation of an intelligent data hub. Unfortunately, it is difficult to find a single solution that you can buy that will do it all, and there is an abundance of technologies for potential use and integration. However, a more sophisticated market is emerging.

To develop the platform architecture and make it contextually appropriate for different audiences, you will need to define the data sources, alerts, trigger events and visualizations that enable a variety of scenarios. Focus first on high-impact events, and indicator-based data sources and technologies that, when curated, provide timely and consumable critical information to epidemiologists, medical personnel and the public. These will be enabled by visualizations, advanced and predictive analytics and API-based data exchange mechanisms such as HL7 FHIR. Pay particular attention to telehealth applications. They can be especially useful in providing effective care pathways and halting the spread of disease — decentralizing the care landscape.

Also consider existing technologies that are already on hand. Many existing technologies have the potential to aid detection, case confirmation, tracking and accurate reporting. Sometimes, it is the older technologies that can be relied on heavily in times of crisis.

This burgeoning market for intelligent health command platforms is here to stay and D&A leaders should keep their eyes open as it evolves. For example, several risk and crisis management business continuity systems have begun adding disease surveillance into their SaaS offerings. Disease surveillance outbreak management systems are being enhanced. Given the devastating effects of the COVID-19 pandemic, we expect this emerging market to increase. We expect more solutions will emerge — especially as health information and surveillance systems are overhauled to address early outbreak detection, and as the global health security agenda (GHSA) and partnerships in health security become a priority once again. Following an epidemic, it is a good time to reflect on what has transpired and plan for the longer term. Strengthening health information systems will require embedding data and analytics and an intelligent health platform.

Recommendations:

1. Plan an intelligent health platform for operational management during and after a crisis.
2. When designing and implementing, plan for the longer term. Evolve the platform's ability to detect new diseases into your routine health practice. This ability should be incorporated into health facilities digitization, medical records, data services and the Internet of Things (IoT). Rely on real-time data (such as location data, event-based and indicator-based surveillance data and data feeds). Use advanced technologies to establish the platform, such as data warehouses, cloud storage, predictive analytics, IoT and AI.
3. Utilize data feeds and subscription services for mass notifications and risk management. Utilize a network of data feeds from worldwide systems that allow for global information awareness.
4. Stay tuned-in and routinely scan for available solutions (see Note 2). This market is quickly evolving.

Acronym Key and Glossary Terms

IDSR	integrated disease surveillance response
PHEOC	public health emergency operations center
Public health surveillance	The systematic, ongoing collection, management, analysis, and interpretation of data followed by the dissemination of these data to public health programs to stimulate public health action (US CDC).

Evidence

[1] "COVID-19 Resource Center." The Lancet.

[2] "Public Health Surveillance." World Health Organization.

[3] "Framework for a Public Health Emergency Operations Centre." World Health Organization.

[4] "Transforming Health Systems Through Good Digital Governance." (PDF). Asian Development Bank.

[5] "Sustainable Model for Public Health Emergency Operations Centers for Global Settings." U.S. Centers for Disease Control and Prevention.

"Delivering Operation Command Centers: Improve Patient Access, Throughput and Financial Stability for Health Systems." MedCity News.

"A Partnership Against Global Health Threats." Global Health Security Agenda.

"Global Health Security: Epidemics Readiness Accelerator." World Economic Forum.

"CDC in Action." U.S. Centers for Disease Control and Prevention.

Note 1: COVID-19

An outbreak of respiratory illness caused by a novel (new) coronavirus was first identified in Wuhan, Hubei Province, China. Chinese authorities identified the new coronavirus (later named COVID-19), which resulted in thousands of confirmed cases in China, including cases outside Wuhan City. On 30 January 2020, the International Health Regulations Emergency Committee of the World Health Organization (WHO) declared the outbreak a "public health emergency of international concern" (PHEIC). On 13 March 2020, the WHO announced COVID-19 outbreak a pandemic.

Note 2: Research on Related Technologies

Gartner has a variety of insightful research pertaining to data and analytics, healthcare and adjacent industries (including Magic Quadrants and Hype Cycles). Organizations should review pandemic scenarios (that is, use cases) alongside Gartner's published resources. This will provide additional insight and help them to identify potentially useful technologies. The following is a nonexhaustive list of related research:

"Magic Quadrant for Business Continuity Management Program Solutions, Worldwide"

"Critical Capabilities for Business Continuity Management Program Solutions, Worldwide"

"Magic Quadrant for Data Science and Machine Learning Platforms"

"Magic Quadrant for Analytics and Business Intelligence Platforms"

"Magic Quadrant for Data and Analytics Service Providers"

“Hype Cycle for the Internet of Things, 2019”

“Hype Cycle for Healthcare Providers, 2019”

“Market Guide for Crisis/Emergency Management Platforms”

“Market Guide for Emergency/Mass Notification Services”

This complimentary research is part of Gartner's ongoing coverage of the business impact of the coronavirus (COVID-19).

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