



# COVID-19 Pandemic Response Solutions

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## Introduction

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As cases of COVID-19 continue to spread at an exponential rate, the global community is tasked with implementing effective solutions to respond to the pandemic. Digital solutions can optimize COVID-19 risk assessment, case reporting, contact tracing, and treatment follow up.

BAO Systems is a leading digital data solutions partner for health and development organizations globally. We empower our partners to implement scalable and sustainable solutions that uncover data-driven insights to improve livelihoods, strengthen health systems, and achieve equitable human development. Given the growing need for deployment and scale up of COVID-19 monitoring systems, we are offering rapid implementation support around digital tools that can facilitate:

- Health care worker self-assessment
- Case-based surveillance
- Contact tracing
- High level case reporting

The following sections describe in greater detail BAO Systems' COVID-19 pandemic response solutions, our implementation approach, and our capabilities.

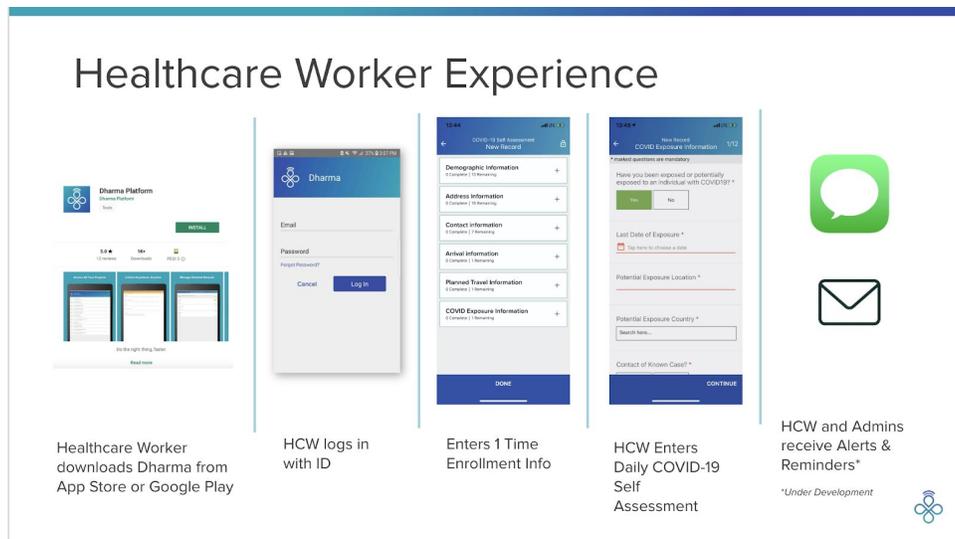
# Technical Solutions

## Dharma Platform COVID-19 Solution

**Dharma Platform**, recently acquired by BAO Systems, is a robust data collection tool that enables quick deployment, with no downtime, of a full data management solution as you first respond to a humanitarian emergency. Dharma enables people with little-to-no technical expertise to rapidly design, implement, and scale a robust, secure and complete ecosystem for data, regardless of connectivity or spoken language, on any device, on or offline. Simply put, Dharma empowers its users with the insights they need to make better decisions and collect high-quality, meaningful data with less time, effort, and cost.

Our Dharma Platform COVID-19 Solution comprises multiple modules for implementation:

- **Health care worker self-assessment.** Aligned with CDC recommendations, the self-assessment module allows health care facilities and workers to assess their own risk. From community health workers completing daily self assessments of their health to surveying beneficiaries on the ground - Dharma's solution provides an intuitive way to immediately collect ground truth data of the population. *Ready to use!*



- **Case-based surveillance.** Aligned with [WHO's case reporting recommendations](#), the surveillance module enrolls and tracks suspected cases; captures symptoms, demographics, risk factors and exposures. *Coming soon!*

### Why use the Dharma Platform COVID-19 Solution?

- **Time.** Our Dharma COVID-19 health care worker self-assessment module is ready to use! Our out-of-the-box COVID-19 solution comes pre-configured and aligned with the CDC recommendations for assessing symptoms and follow up of COVID-19. Configuration of new modules have fast turnaround time, reducing the time spent deploying complex data collection tools. The number of cases globally are increasing exponentially, necessitating effective surveillance tools immediately.

- **No training for end users.** Dharma Platform's intuitive mobile interface makes it extremely easy for end users to enter data with no training. Users download the app on their Android or iOS device, log in, and immediately start entering their symptoms. With offline capabilities, users can collect data anywhere, anytime and it will automatically sync to the Cloud when connected to cellular or wifi without any prompt from the end user.
- **Scale.** Dharma Platform's Software-As-A-Service (SaaS) model allows for instant scaling of data collection in any environment. With our GDPR compliant and highly secure platform, organizations can ramp up data collection instantly without dealing with any infrastructure for hosting requirements.
- **Alignment with CDC and WHO recommendations.** Alignment with CDC and WHO COVID-19 recommendations and implementation of a standardized tool enables the global community to share insights at the global, national, subnational, and local levels. Ultimately, this will contribute to a more coordinated COVID-19 pandemic response.

### How can BAO Systems help?

- **Deploy now.** BAO Systems can implement the Dharma COVID-19 Solution with limited lag time. With the pre-configured health care worker workflow already in place, all organizations need to provide are user names and profiles to quickly start entering data. BAO Systems will help train administrators on reviewing dashboards and analytics and how to support user management.
- **Customize.** Dharma Platform was built for no-code configuration changes. If your organization requires additional modifications to the out-of-the-box COVID-19 Solution, our team of experts will help train and configure changes in workflow, skip logic, and data elements captured.
- **Integrate with DHIS2.** BAO Systems is currently developing a Dharma-to-DHIS2 Connector that will facilitate automated, scheduled data flow captured in Dharma to populate DHIS2 for aggregate reporting, advanced analytics, and widespread data sharing. The connector will enable alignment with pre-existing organizational unit hierarchies, creation of novel indicators, and co-analysis and visualization of integrated data sets. Utilization of the connector will facilitate seamless reporting into aggregate surveillance or other information systems (e.g.HMIS), improving health care worker efficiencies and freeing up staff to analyze and use the data.

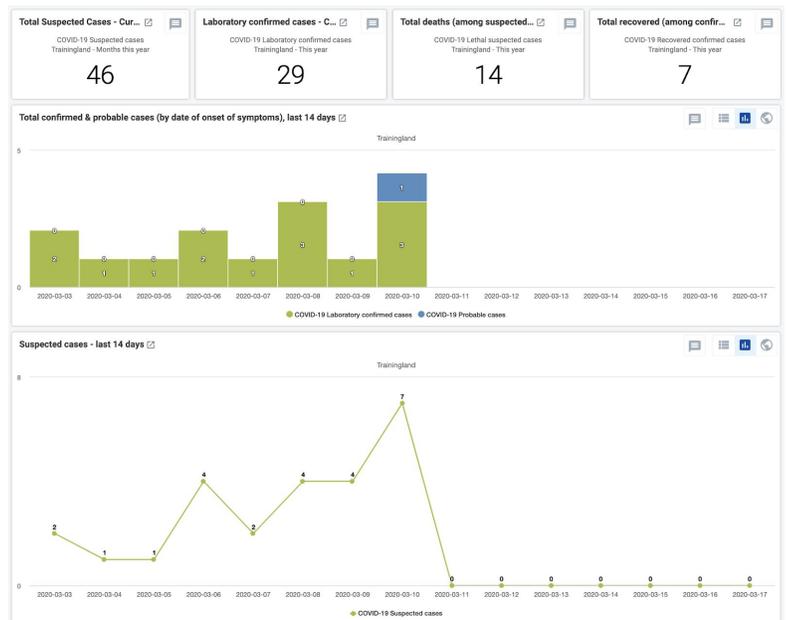
## DHIS2 COVID-19 Surveillance System

**DHIS2**, developed and maintained by the University of Oslo (UiO), is an open-source data collection, management, and analytics platform that is implemented in 67 countries at a national scale as the HMIS as well as by numerous development organizations. As a Global Good, DHIS2 is a sustainable, scalable solution that has proven efficacy in improving the availability and accessibility of data to inform planning and decision making.

The DHIS2 team recently released a free-to-use [COVID-19 Surveillance Package](#)<sup>12</sup> for download and installation, for which they are continuing to add additional configuration packages. The COVID-19 Surveillance Package is a standard configuration aligned with [WHO's case reporting recommendations](#):

- **Case-based surveillance.** The surveillance configuration utilizes the Tracker data model and is optimized for Android data collection. The program enrolls and tracks suspected cases; captures symptoms, demographics, risk factors and exposures; creates lab requests; links confirmed cases with contacts; and monitors patient outcomes. *Ready to use!*
- **Contact-tracing.** The configuration package will strengthen active case detection through contact tracing activities, such as identification and follow-up of contacts of a suspected or confirmed case. *Ready to use!*
- **Ports of entry.** The configuration package enrolls travelers who have visited high-risk locations at Ports of Entry for 14-day monitoring and follow-up. *Ready to use!*
- **High level case surveillance.** Given the challenges faced in many low- and middle-income settings to implement nationwide patient tracker systems, the DHIS2 team is also developing a surveillance package utilizing the Aggregate and Event data models.
- **Event-based surveillance.** The configuration package is a simplified form to capture a subset of critical data points for contexts where case-based surveillance is a challenge.
- **Aggregate-based surveillance.** The configuration package is a simplified form to capture a subset of critical data points for contexts where case-based surveillance is a challenge.

The DHIS2 COVID-19 Surveillance System can be demoed here (login provided): [DHIS2 COVID-19 Surveillance Interactive Demo](#).



*Shown at right is an example dashboard created in the DHIS2 COVID-19 demo. The dashboard displays new COVID-19 cases to date, and over time.*

<sup>1</sup><https://www.dhis2.org/covid-19>

<sup>2</sup>Countries implementing the COVID-19 DHIS2 configuration package as of 17 March, 2020 include: Afghanistan, Bangladesh, Colombia, Ethiopia, Honduras, India, Indonesia, Laos, Lebanon, Senegal, Somalia, Sri Lanka



## Why use the DHIS2 COVID-19 Surveillance Package?

- **Global scale.** DHIS2 is implemented globally at the national level or pilot stages, enabling easier interoperability with existing health information systems. Data can be collected offline and through mobile devices, with Cloud syncing when internet connectivity is available.
- **Existing capacity.** Ministries of Health and organizations supporting them, including emergency response organizations, have existing cadres of DHIS2 expertise, allowing implementers to leverage existing staff to support a COVID-19 surveillance system. This will enable countries and organizations to deploy and scale their surveillance system faster and more efficiently.
- **Alignment with WHO recommendations.** Implementation of a standard configuration package enables the global community to share insights at the global, national, and sub-national levels using standardized data. Ultimately, this will contribute to a more coordinated pandemic response across geographical boundaries.

## How can BAO Systems help?

- **Install.** Our team of DHIS2 experts can help your organization install the DHIS2 COVID-19 Surveillance Package in a new or existing DHIS2 instance. We can support alignment with existing organizational unit hierarchies, and/or additional customization of the standard COVID-19 Surveillance configuration package to meet the specific needs of your emergency response team. Our BAO Import Foundry (BIF) tool is a user-friendly configuration tool used to quickly and easily create metadata objects in DHIS2 in bulk upload form, thus enabling quick deployment of any customizations to the COVID-19 Surveillance Package.
- **Extend monitoring capabilities.** The COVID-19 pandemic has caused extensive strains on health systems globally, with reports indicating short supply of essential test kits, ventilators, gloves, masks, among other supplies and equipment. Furthermore, hospitals, health centers, and other care facilities anticipate shortages in health provider capacity. Our team can extend the capability of DHIS2 COVID-19 Surveillance Package through additional configuration to capture additional data, such as commodities, as needed.
- **Analyze.** Our team excels at calculating program indicators and using the DHIS2 visualization application to create compelling dashboards and routine reports that are easy to understand by data end users at multiple health system levels.
- **Extend DHIS2 functionality.** We have extensive experience in building custom applications to extend core DHIS2 features and functionality and can provide support around developing new or leveraging BAO Systems' pre-built applications to improve DHIS2 functionality. One example is our longer term offline functionality, which enables data collectors to be in the field attending patients and collecting data for longer periods without having to move to areas with internet connectivity. This feature is of particular relevance in high risk and underserved areas such as conflict zones, IDP or refugee camps, and rural locations with poor connectivity. These areas are of particular risk for poorer outcomes as the result of a COVID-19 outbreak given the crowded living areas and/or great distance to adequate health services.

- **Host.** We offer a number of [DHIS2 hosting plans](#) and provide many additional services that improve ease of management, stability, security, and performance of your DHIS2 instance. We can quickly set up a secure and reliable hosting environment for your DHIS2 instance. Through our help desk, users can find self-service help through access to a knowledge database or, if the answer is not apparent, open a helpdesk ticket to be promptly addressed by BAO Systems support staff. Our staff in multiple time zones are available to assist with responding to requests to ensure 24-hour support and the fastest turnaround time possible.

## Dharma-DHIS2 COVID-19 Integrated Solution

Using Dharma and DHIS2, BAO Systems can quickly develop an Integrated Surveillance Solution that enables COVID-19 responders to leverage the best of both worlds: an easy-to-use frontline health care worker tool that automatically aggregates and reports cases into a high-level DHIS2 surveillance system where hospital administrators, county/district health departments, state/provincial health departments, and national health agencies can view, interpret, and use data for response planning.

### Why use the Dharma-DHIS2 COVID-19 Integrated Solution?

- **Low barrier to entry.** Dharma Platform's intuitive interface was developed to enable health care workers to use the platform with no training. Front line providers do not need to have prior experience using DHIS2 or advanced technology skills to begin data collection.
- **Seamless reporting.** Our connector will extract the necessary data from Dharma and facilitate automated, scheduled reporting into an aggregate DHIS2 COVID-19 Surveillance System. This will enable governments to monitor the COVID-19 epidemic across health system levels and encourage data use for response planning at each of these levels.
- **Standardization.** Implementation of standardized tools enables coordinated epidemic analysis and response planning.

### How can BAO Systems help?

- **Customize, deploy, and host.** We can customize, deploy, and host an integrated solution to meet your COVID-19 response needs. Our team has extensive experience in Dharma and DHIS2 configuration, as well as building custom DHIS2 connectors to schedule automated data flow between systems.

## Other COVID-19 Solution Integration with DHIS2

BAO Systems recognizes that COVID-19 pandemic responders have a variety of digital tools to select from to facilitate multiple types of data collection activities, including but not limited to patient health and physicals, self-assessments, community surveys, case reporting, port of entry forms, essential medicines and commodities inventories, etc. BAO Systems firmly believes in leveraging existing infrastructure, systems, and capacities where possible, particularly when time is critical.

Our suite of integration tools enable automated data exchange between DHIS2 and other primary data collection tools as well as advanced visualization and business intelligence (“BI”) tools.

### **Why integrate with DHIS2?**

- **Comorbidity and other integrated data analysis.** With widespread use of DHIS2 amongst Ministries of Health and organizations supporting them, integration of surveillance data with other health information systems will enable decision makers to better understand potential relationships and comorbidities. For example, in populations where HIV/AIDS is prevalent, there is increased risk for adverse health outcomes with COVID-19 coinfection. The ability to co-analyze these siloed data sets will be essential to appropriately, effectively, and timely respond to and/or predict epidemics. PEPFAR’s global HIV/AIDS reporting system, DATIM, is built on DHIS2, and thus presents an opportunity to co-analyze COVID-19 and HIV/AIDS cases.
- **Data sharing.** In many parts of the world, borders are porous, and this can be exacerbated during times of epidemics - case in point the recent Ebola outbreak in the Democratic Republic of Congo. Integration across multiple COVID-19 surveillance systems at the regional or global levels will improve coordinated analysis, planning, and response. The risk of the pandemic will only decrease as countries work together to share information and alerts of potential outbreak “hotspots”. DHIS2 integration increases the potential for data sharing across individual surveillance systems.

### **How can BAO Systems help?**

- **Leverage our Integration Suite of tools to facilitate data exchange from primary data collections systems to DHIS2.** BAO Systems has developed a number of upstream system connectors that facilitate automated and scheduled data flow from data collection tools into DHIS2, including from KoBo/ODK, CommCare, and others. As mentioned above, we are currently building our Dharma-to-DHIS2 connector, which can be accelerated to meet user demand.
- **Utilize our Integration Driver to facilitate DHIS2-to-DHIS2 data exchange.** BAO Systems’ Integration Driver facilitates multi-direction data flow between two or more DHIS2 instances. This can be especially useful in countries where multiple DHIS2 instances are implemented, such as for HMIS and case based surveillance systems. In cases where multiple countries deploy the DHIS2 COVID-19 Surveillance Package (or otherwise utilize DHIS2 to track COVID-19 data), our Integration Driver will make it feasible to facilitate data flow from country level systems into a single global level DHIS2 instance for improved pandemic tracking.
- **Connect DHIS2 to popular BI tools such as Tableau or Power BI.** BAO Systems has developed downstream DHIS2 connectors to Tableau and Power BI to meet the growing need for advanced analytics, data visualization, and data sharing. This enables responders to more globally view their COVID-19 data with the context in which the epidemic is occurring. For example, Ministries of Health, multilateral agencies, and other organizations will be able to integrate surveillance data together with financial data, thereby being able to more efficiently and effectively assess the economic impact of COVID-19 response interventions.

## Implementation Approach

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BAO Systems will leverage its extensive expertise in deploying large scale information systems to customize our solutions to the unique COVID-19 pandemic response needs.

### Discovery

Our team is adept at rapid, virtual requirements gathering and system design. During the Discovery phase, BAO Systems will understand any unique data needs that may affect customization of our proposed solution(s) above. We will request access to and review key documentation, as needed, as well as discuss with stakeholders their current data flow processes, pain points, and data analysis needs with an emphasis on implementing a fit-for-purpose solution.

### Configuration/Development

Using this information, our team will tailor the appropriate COVID-19 Pandemic Response Solution(s) through configuration and/or development of new functionality to meet the unique needs for each implementation. We will rapidly and iteratively customize, conduct quality assurance, and test the solution, ensuring that it meets the needs of end users, whether it be providers collecting data or COVID-19 response managers. We will work with stakeholders to pilot the solution prior to widespread deployment.

### Training

We provide remote and onsite customized training for system administrators and end users in the implementation, management, and use of our solutions. We offer coaching to grow your team's comfort with using our COVID-19 solution for seamless integration into your data collection, management, analysis, and use efforts.

## About BAO Systems

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Our team comprises passionate global development professionals, health information system specialists, data scientists, software engineers, hosting experts, and capacity-strengthening specialists. The BAO Systems team is well-versed in governance, compliance, data and information security, and has deep technical expertise in application development. Our technically diverse team and extensive experience not only grants us a unique perspective to understand the challenges faced by implementers but the ability to develop scalable and sustainable solutions. We strive to ensure that data are available, accessible, digestible, and used for programmatic decision-making across all levels of a health system.

Our team excels in providing a broad spectrum of services and solutions: technical advising, end-to-end DHIS2 and Dharma Platform implementation, training and capacity strengthening, systems integration and interoperability, custom application development, analytics, and hosting.

BAO Systems is a leader in supporting organizations, including Ministries of Health, to design, configure, and deploy DHIS2 to meet their data needs. We provide scalable, secure, and

compliant cloud hosting environments as well as responsive HelpDesk support so that our partners can focus on using data in their system.

Our team has supported DHIS2 and Dharma Platform implementation with more than 100 partners present in about 70 countries, including with Ministries of Health, U.S. based Departments of Health, international NGOs, and the private sector. We currently host and support over 400 DHIS2 instances.

## Relevant Work

**Accès aux Soins de Santé Primaires (Access to Primary Health Care) in the Democratic Republic of Congo (ASSP) |** As a subcontractor under ASSP, BAO Systems supported the DRC Ministry of Health's Health Management Information Systems (HMIS) team to improve the capture, management, analysis and use of routine health data for informed decision-making at the national and sub-national levels with a focus on using data to improve health outcomes. BAO supported the Ministry of Health in creating data visualizations and dashboards tailored for different decision-makers, such as reports targeted at Provincial Health Information Officers to understand where to focus health service delivery improvements. Our team has worked to build the capacity of the Ministry of Health officials to manage their systems independently through a combination of coaching and formal training. DRC's HMIS team now has improved capacity to independently manage and expand their national HMIS, as demonstrated in the rapid rollout of an early response Ebola surveillance system.

**Enhancing Services and Linkages for Children affected by HIV and AIDS (ELIKIA) |** BAO Systems supported ELIKIA, a 5-year USAID activity in the Democratic Republic of Congo. The program improves the health, well-being, and economic security of over 47,000 orphans and vulnerable children, and 16,000 vulnerable households. BAO Systems supported the design, architecture, configuration, and deployment of ELIKIA's DHIS2 database, which collects aggregate and client level data. Two distinct Tracker programs were created: the first to track individual beneficiaries and the second to track households. We further supported linking of the two tracker programs together, while maintaining the integrity of Tracked Entities. We supported the customization of dashboards and reports, which displays information organized by partner, health zone, and community health worker levels.

**Palm Beach County, Florida, USA Homeless Outreach Survey |** Utilizing Dharma Platform's mobile data collection application, Palm Beach County completed digital surveys for the first time to rapidly measure and gain insight into the county's homeless population. Through an agile, mobile application, officials, and local volunteers used Dharma Platform to conduct surveys, online and offline, digitally transforming the collection process from the previous two-week timeline to a single day. Transformation to real-time data collection in a privacy compliant cloud database drastically shortened county officials' data collection time, and analysis of their survey data shrank from more than three months to just 14 days. Unlike the common struggles associated with digital transformation, the Palm Beach County officials and volunteers were surprised to find how easy it was to implement the Dharma Platform.

**Seva Foundation |** Dharma Platform works with Seva Foundation to digitally transform their historical data records and streamline, standardize, and secure their record-keeping across hundreds of hospitals. Providing basic medical treatment to remote populations of people who historically lack access to eye care makes a world of difference to people and families,

preventing blindness before it can happen. Partnering with eye hospitals around the world, like the Guatemala-based Clínicas Visualiza, the Seva Foundation provides critical eye care to underserved communities, especially women, children, and indigenous populations. Together, Seva and Visualiza have reimagined their global and local data practices to move toward a cohesive data architecture capable of delivering impact at scale both in Guatemala and around the world.

## CONTACT US!

Reach out with any questions about our COVID-19 pandemic response solutions specifically, or about BAO Systems generally.

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