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JANUARY 2021

COVID-19 Vaccination

Experience & Approach

DELOITTE'S STARTING POINT

International experience combined with deep insight in the local healthcare system

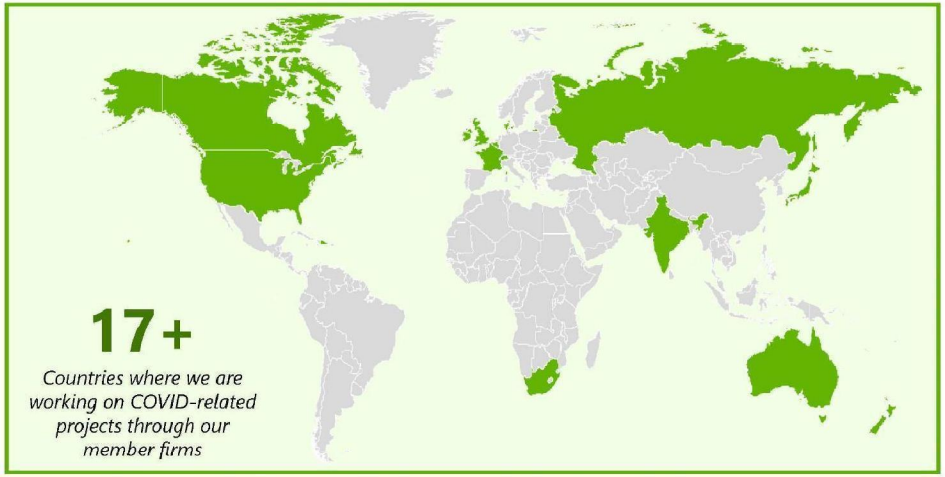
- Deeply engaged in supporting federal and state governments across the world and in Australia across the COVID-19 end to end value chain
- Thorough knowledge of vaccination **registers (IIS) & other relevant information systems (ELR, EMR, GPs systems)** and the ability to integrate these with emerging COVID-19 requirements
- Significant experience with the **quick development of solutions** for vaccination distribution, administration, surveillance & management with a range of alliance partners (Salesforce, Microsoft Dynamics, Oracle, Adobe, Amazon Connect etc)
- **Experience collaborating** with state governments to develop relevant operating models across different population cohorts (push/pull; rural/remote; vulnerable/employers etc)
- Extensive experience with preparation and management of **complex programs** where coordinated planning and execution of efforts across multiple stakeholders must be provided in **real time**.

DELOITTE'S STARTING POINT

Deloitte COVID Vaccine Engagements Overview: By The Numbers…

5000+

Deloitte practitioners supporting COVID-vaccine related projects around the world



17+

Countries where we are working on COVID-related projects through our member firms

80+

Engagements that span both the COVID value chain and stakeholder groups

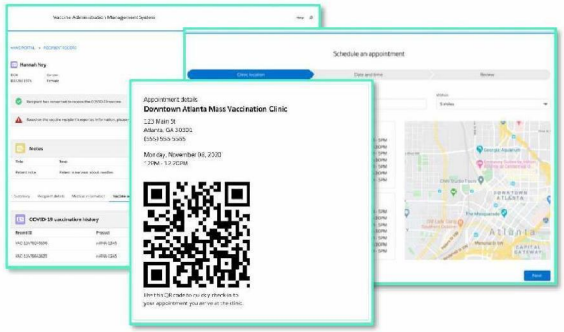
Testing & Contact Tracing	Vaccine Distribution	Vaccine Program Management[1]	Vaccine Administration Management	Communications / Research	Pharmacovigilance	Commercialization
17	7	32+	2	7	3	6

NGO's	Federal Governments & Agencies	Local Governments & Agencies[1]	Vaccine Manufacturers
5	17	36+	12

1. This figure includes 20+ US states where we are performing COVID vaccination related work

Deloitte. Digital | **GovConnect**

Vaccine Management & Tracking



Deloitte's Vaccine Management & Tracking solution is helping federal & state governments to **manage vaccine distribution at scale and expedite vaccine administration**. The solution is designed to provide **patient self-service and messaging to support contactless registration and communication** with the public, **clinic management to streamline the establishment and operation of points of dispensing (PODs)** by capturing vaccine administration details both online and offline, and **real-time access to vaccine inventory and administration data** to support decision-making. Our platform **compliments and integrates with existing Immunization Information Systems (IIS)** to help states and jurisdictions meet new challenges of mass vaccine distribution.

FEATURES

Patient Self-service and Follow-up Reminders
Recipients can **schedule appointments** with facilities and manage their registration and pre-screening through a mobile-friendly portal to reduce the amount of time that needs to be spent in-person at the vaccination site. **Follow-up engagement for second-dose appointments** and adverse event surveys can be managed through this portal as well.

Client Encounter and Vaccine Administration
End to end **management of Points of Dispensing (PODs**) from clinic and staff onboarding to capturing and documenting vaccine administration. Manage clinic appointments, register and check-in patients, verify recipients, process consent forms, record administration, and generate vaccine certificates using streamlined and efficient workflows reducing patient touchpoints.

Integration with Federal and Jurisdiction Systems
Our system **integrates via an HL7 interface with state Immunization Information Systems (IISs)** to reduce the need for duplicate entry of immunization information. Provider and allocation information can also be generated and sent to federal systems such as VTrckS.

Vaccination Pre-Screening & Program Communication
Education and outreach to critical populations can be coordinated through our system to **provide the public with accurate information including about eligibility** and Emergency Use Authorization (EUA). Additionally, the platform can be used for pre-screening and registration by phased population, inclusive of email and text notifications.

Provider Recruitment and Enrollment
Helps jurisdictions build and maintain a network of vaccination providers by leveraging existing provider networks and onboarding new clinics or Points of Dispensing (PODs) that will adhere to both state and federal conditions of the vaccination program.

Capacity Planning and Allocation
Tools and integrations to collect information about capacity to understand **maximum achievable vaccination throughput** and allocate supply across jurisdictions according to data-driven insights. Our solution can incorporate multiple data sources to provide states and jurisdictions a full picture of conditions in real-time.

Inventory Storage and Handling
Dose-level accountability of inventory beginning at the manufacturer or supplier through shipment and administration. Features such as 2D barcoding scanning, site-level inventory management, Lot ID tracking, and real-time updates streamline the process of maintaining vaccine cold chain and ancillary supplies.

Data Analytics & Program Monitoring
Data can be aggregated from our solution and reported to multiple internal and external stakeholders to meet the strict 24 hour reporting guidelines for vaccine administration. Additionally, data modeling and integration of social drivers of health data can **identify populations and geographies for priority vaccination events**.

BENEFITS

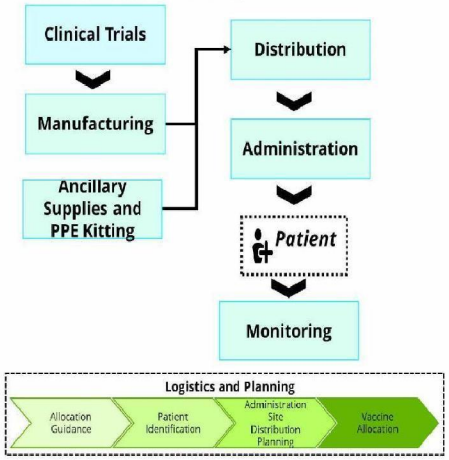
- Offers integrated **Cybersecurity and Privacy**, enabled by Deloitte Cyber.
- Offers public health officials **insights to guide strategy and policy** through evolving vaccination guidelines
- Provides a **comprehensive view** of the vaccine supply and demand.
- **Mobile-ready interfaces** for both patients and clinics with capability for **offline support**.
- **Modular design** allows features to **integrate with existing systems** while reducing duplicate entry.
- Increases **operational and full situational awareness** with clear reporting of data across various sources.
- **Reduces manual effort** by incorporating process automation.
- **Reduces burden** of data collection for health staff and improves accuracy of self-reported data.

DELOITTE'S STARTING POINT

As Deloitte continues to be selected to deliver COVID-19 vaccine programs, our industry expertise is complimented with unparalleled quals; Central Vaccine PMO Team coordinates global efforts

Vaccines Process Flow

Experience spans from clinical trials to patient recruitment & monitoring with a series of alliance partners (Salesforce, Adobe, Oracle, AWS…)



Deep Vaccines Experience

80+ Vaccines-Related Engagements across 17+ Geographies, including:

- **Vaccine Supply Chain and Distribution** (e.g., Test-on-import blockchain solution development, secure supply chain solutions and PMO support))
- **Vaccine Administration and Management Platforms** (e.g., supporting multiple US States and countries with an SFDC-based solution to register, schedule and track inoculations)
- **Vaccine Education** (e.g., developing an Adobe-based HCP engagement/medical information tool in Japan)
- **Vaccine Safety Systems** (e.g., implementing ConvergeHealth cognitive case processing for pharmacovigilance)
- **Vaccine Risk Assessments** (e.g., vaccine contract risk assessments, brand protection labs)
- **Vaccine Finance Support** (e.g., financial modeling, health economics and outcomes research, market assessments)

Global Coordination

Deloitte's Global Vaccine PMO Team leverages experiences / insights and resources from around the world to support our local delivery of vaccine programs

- Centralised repository of knowledge from clinician expertise / insights gains through vaccine engagements across the world
- Development and alignment of assets and solutions
- Established alliance partners with experience building vaccine varying archetypes

DELOITTE'S STARTING POINT

COVID-19 Vaccination Value Chain

We have a strong understanding of the vaccination value chain and how existing capabilities can be leveraged

Core Operations

1 Partner & Individual Engagement

a. Engage w/ employers, Govt. agencies

b. Assign individual to cohort *(self-identify)*

c. Align cohort w/ public health allocation plan

d. Determine cohort eligibility (i.e. sequencing)

e. Notify individual of vaccination eligibility

f. Map patient to vaccination site

g. Send medical questionnaire and consent form to patient

h. Confirm vaccination appt and patient consent

2 Procurement

a. Determine site storage capacity & current vaccine inventory (by vaccine brand/type)

b. Calculate order amount based on vaccine demand

c. Place vaccine order, by vaccine brand/type

d. Approve site (administering provider) vaccine order

e. Send vaccine order approval and shipping info to site / provider

3 Logistics and Distribution

a. Forecast vaccine & supplies demand on ongoing basis

b. Coordinate logistics and warehouse operations

c. Track order from manufacturer to warehouse

d. Confirm order receipt and validate cold-chain integrity

e. Manage and track daily distribution to administering sites

4 Site Management

a. Identify, contract, and certify administering site

b. Determine site governance & oversight

c. Develop emergency response plan, incl. EMS/ hospital relationships

d. Devise site security and personnel safety plan

e. Maintain site (daily sanitizing, daily setup)

f. Manage on-site supply and inventory

g. Process inbound vaccine shipments

5 Vaccine Administration

a. Manage patient intake & initial health screening

b. Thaw doses according to specified instructions

c. Scan & validate vaccine dose for patient appt.

d. Verify patient consent & administer vaccine

e. Monitor patient for adverse / allergic reaction

f. Log administration data & capture adverse events

g. Deliver vaccine certification to patient

h. Schedule 2nd dose appt (if applicable)

6 Revenue Cycle and Billing

a. Determine heath insurance status and info

b. Submit claims and manage collection process

c. Invoice separate administration fee (if applicable)

d. File with Govt. agencies for reimbursement of uncompensated care

7 Monitoring & Adverse Event Reporting

a. Send reminder to patient for 2nd appt (if required)

b. Report total vaccines administered

c. Report adverse events daily and in summary (to manufacturer, to regulator)

d. Track any long-term adverse events in coordination with PCP's

Enablement

8 G&A

a. Talent and HR: Hiring, training, and staffing of personnel for vaccine handling, administration, and medical and administrative adverse event management

b. Finance: Financial reporting & re-imbursement

c. Legal, Compliance, & Regulatory: Regulatory adherence, entity and tax planning

d. Marketing & PR: State and customer relations coordinated with customer outreach, PR communications

e. Facilities: Administration, storage (including Digital Data Logger monitoring & reporting)

f. Information Technology: Maintain HIPAA compliant informatics systems

9 Informatics

a. Immunization Information System (IIS) or Vaccine Administration Management System (VAMS) access & onboarding

b. Electronic Health Record system

c. ERP for supplies management

d. Logistics tracking through Vaccine Tracking System (VTrckS)

e. Adverse event reporting through Vaccine Adverse Event Reporting System (VAERS)

f. Analytics & forecasting

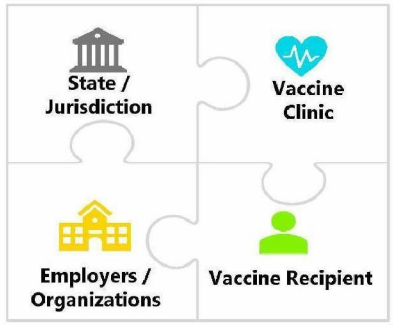
g. Patient-facing applications (e.g., Scheduling, "Vaccine Passport")

US Vaccine Administration Managment System (VAMS)

5.1.2e

VACCINE ADMINISTRATION MANAGEMENT SYSTEM

The US Federal Government engaged with Deloitte to develop, implement and operate a vaccine distribution system for use by States, Federal Agencies and selected providers



Supporting:

- *10 States/40+M population*
- *3 Federal Agencies*

Delivered:

- *600K+ Vaccinations administered*
- *4,000+ Clinics Supported*
- *10,000 Help Desk calls completed*

Work Performed...

Strategy and Planning

- Strategy for modernizing vaccine tracking process; planning for COVID 19 vaccine tracking
- Strategy, measurement and data analysis for equity (with focus on race) in vaccine distribution. Rapid implementation for COVID 19 vaccine program

Systems Development

- Design, developed, implement and operate a vaccine administration system to support jurisdictions without a system that meets the functional, scale and/or reporting needs for the COVID vaccine
- 10 States, 3 Federal Agencies and 1 Health care provider are currently using the system

Jurisdiction and Provider Support

- Full suite of on-boarding services provided to jurisdictions and providers including, training, jurisdiction and clinic set up, organization and user set up and on-going support
- Contact Center for jurisdictions and providers
- On-going systems upgrades and enhancements

Lesson Learned...

Planning

- Change is consistent; clear, concise and timely communication is critical
- Matching supply and demand, and managing eligible cohorts, is critical in the early stages
- Available vaccinators and vaccine distribution end points is the primary constraint

Systems

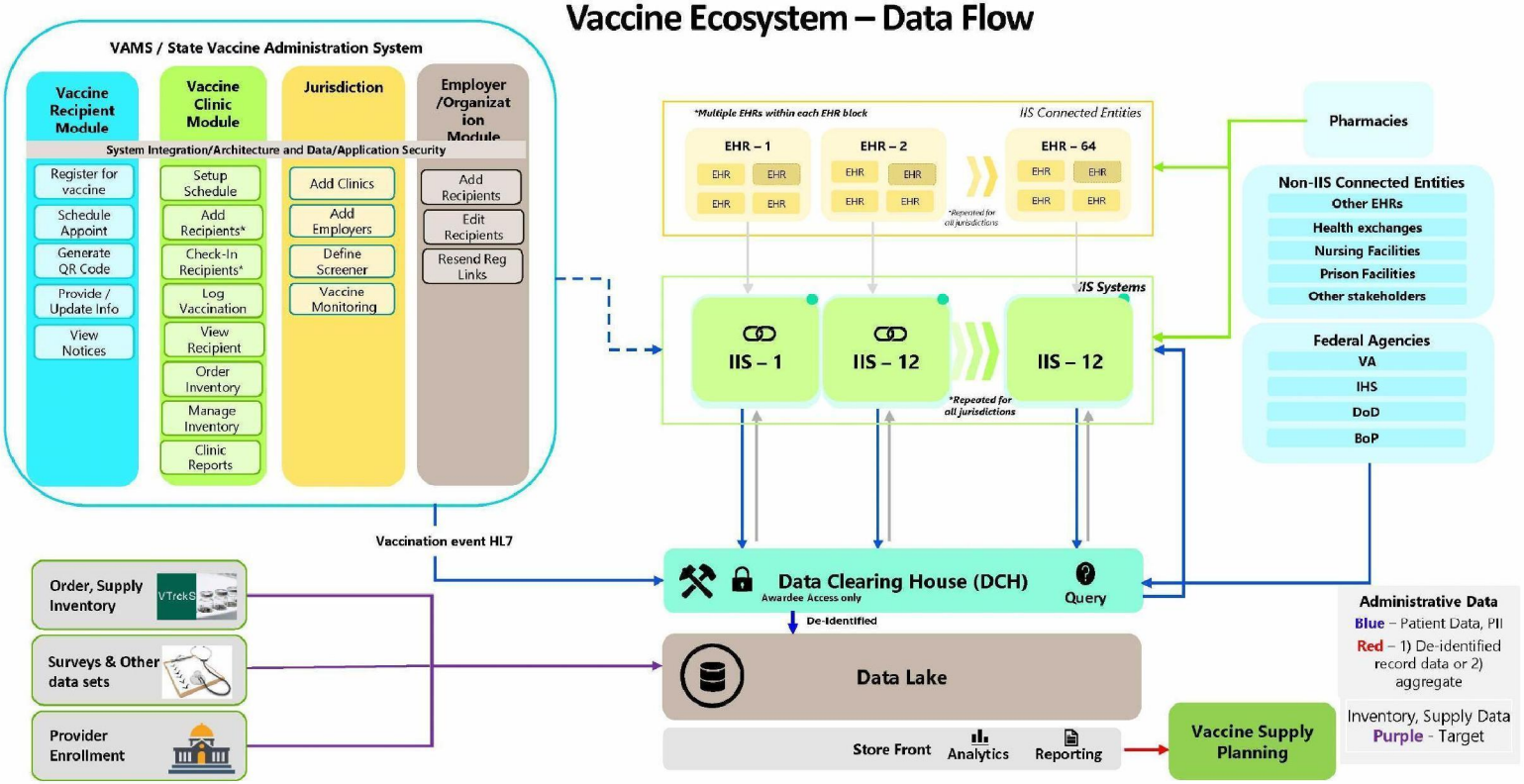
- Build in delivery system flexibility to accommodate change
- Design for maximum volume
- Logistics/appointment scheduling is key to user experience
- Balance between flexibility and control
- Balance between privacy and security and accessibility
- Whitelist e-mail addresses

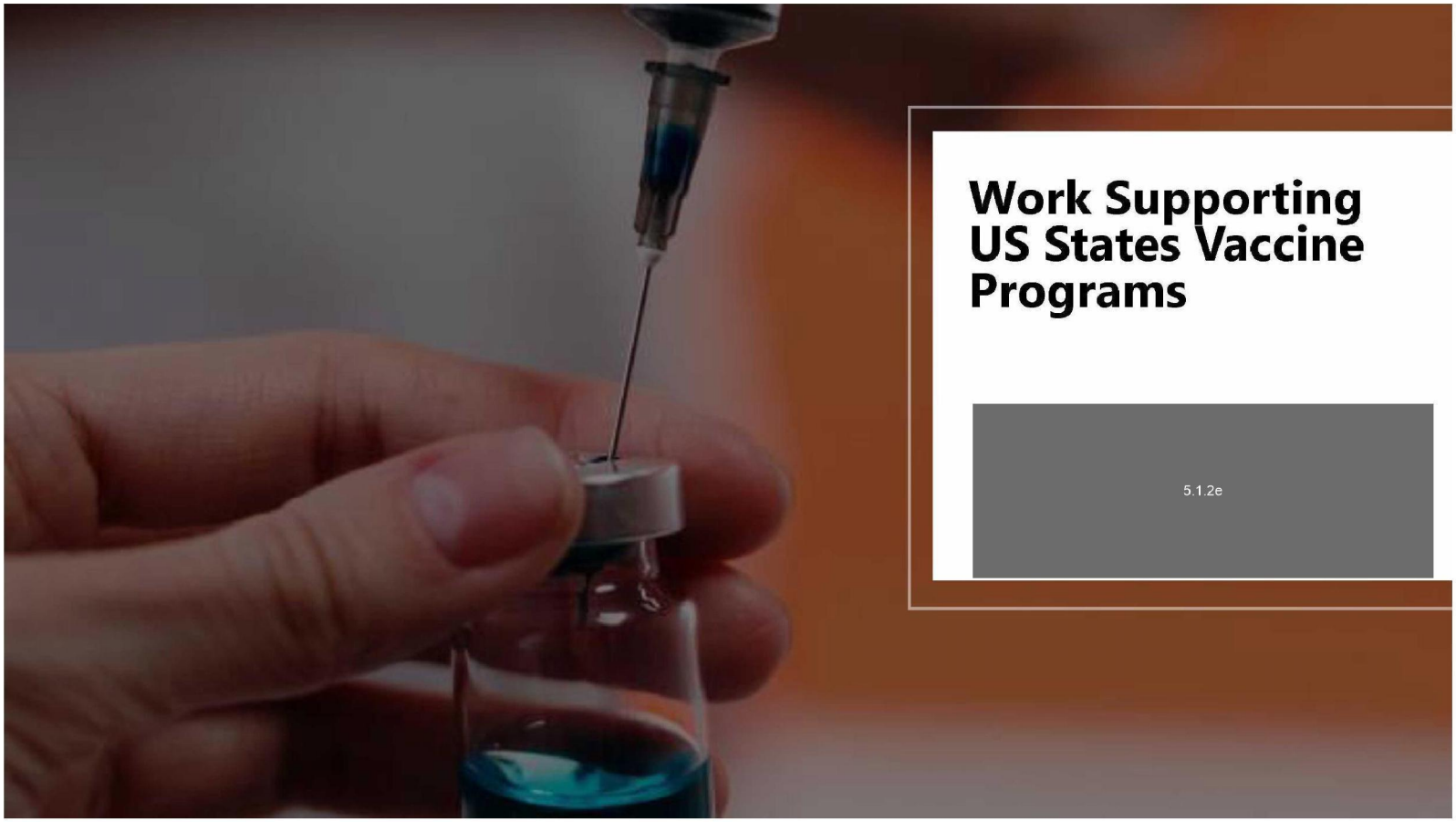
Support

- Plan for high volumes at Contact Centers, and surges when new information is released
- Encourage compliance with training tasks
- Establish on-going cyber attack monitoring and performance monitoring early
- Expect evolution of system functionality

VACCINE ADMINISTRATION MANAGEMENT SYSTEM

Vaccine Ecosystem – Data Flow





Work Supporting US States Vaccine Programs

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WORK SUPPORTING US STATES VACCINE PROGRAMS

Deloitte's solutions support the efforts of US States in COVID-19 vaccine planning, distribution, and management in response to ongoing direction providing by CDC, OWS and other relevant organizations.

Commonwealth of Virginia
Vaccine Planning

Supporting Virginia in vaccine logistics planning, supply chain, communications, and a wide range of program mgt functions.

State of Texas
Vaccine Distribution

Developed a COVID-specific vaccine ordering and management system to provide the functions necessary to order and distribute vaccine.

State of New Hampshire
Vaccine Management

New Hampshire engaged Deloitte to develop and launch a COVID-specific Vaccine Management System for registration, screening and administration of vaccine.

State of New York
Vaccine Planning & Analytics

Supporting State with vaccine logistics, operational and strategic planning, supply chain, communications and crisis communications, call center support, data analytics, IT backbone, and a wide range of program mgt functions.

Lessons learned through these efforts:

Invest in distributional planning

- Move to lower priority before current priority is 'complete'
- Anticipate rush of early interest
- Considering "end to end" experience from interest list to scheduling to follow-up

Prepare for significant emphasis on Adverse Events

- High degree of interest from public on potential adverse vents
- Share information about what to expect and what to monitor

Two Dose Management

- Schedule 2nd dose at first appointment

WORK SUPPORTING US STATES VACCINE PROGRAMS

Vaccination Administration Process Flow

	Provider Enrollment	Inventory Management	Vaccine Recipient Screening	Vaccine Recipient Portal & Tracking	Clinical Decision Making	Informative Analytics	Data Exchange
	Provider enrolls in program	**Provider** requests needed vaccines	**Provider** sets appointment times	**Provider** administers vaccine	**Provider** monitors vaccination process	**Provider** compiles data & reports	**Provider** reports data to state / local
	Vaccine Recipient identifies provider in their area	**Vaccine Recipient** confirms access to vaccines in their area	**Vaccine Recipient** completes pre-screening	**Vaccine Recipient** receives vaccination	**Vaccine Recipient** can report adverse effects	**Vaccine Recipient** signs waiver to share data	**Vaccine Recipient** access vaccination history
	State / Local manages enrollment process	**State / Local** manages distribution process	**State / Local** sets eligibility guidelines	**State / Local** tracks vaccination rates	**State / Local** tracks adverse effects	**State / Local** receives & analyzes data	**State / Local** receives & reports data to CDC

Insights from Deloitte's Involvement in the Global Vaccine Working Group

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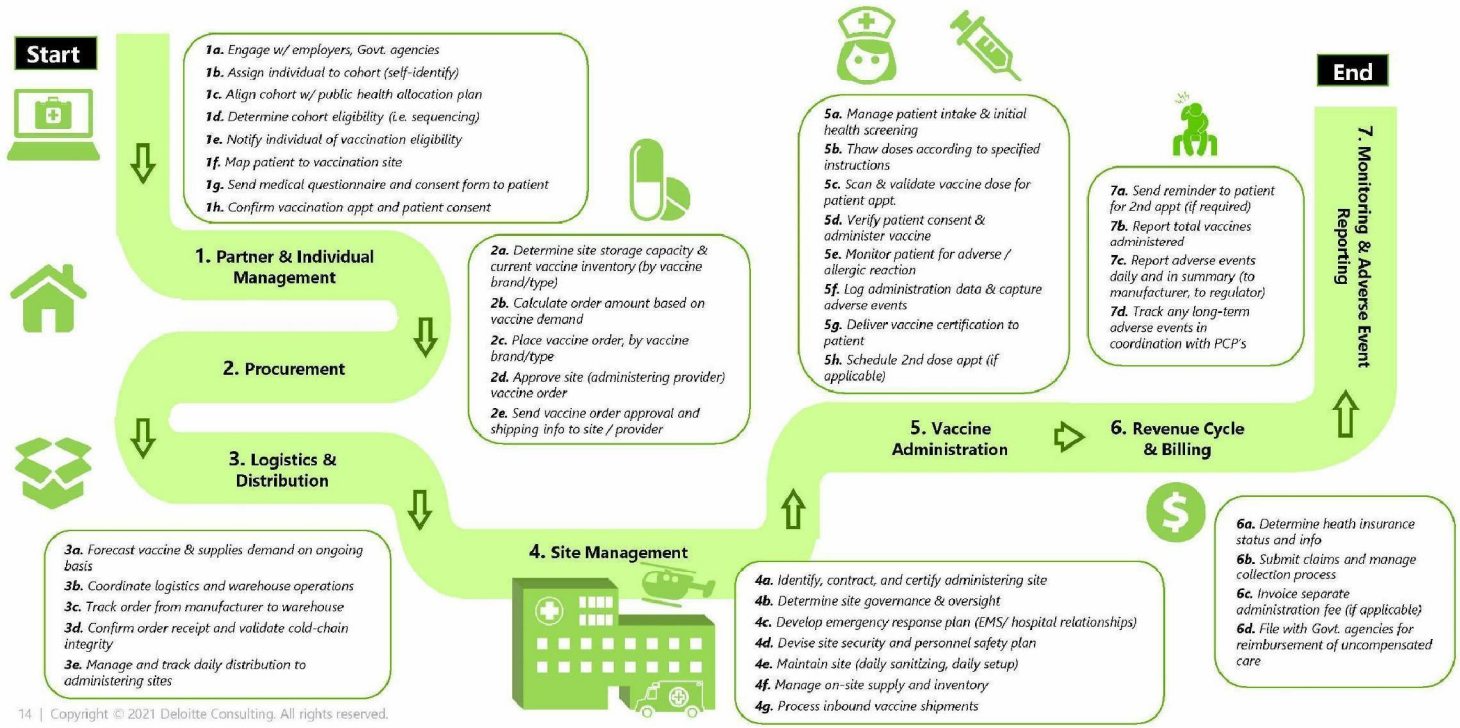
MASS VACCINATION

Mass Vaccination Site Setup – Vaccination Journey



MASS VACCINATION

Mass Vaccination Site Setup – Site Evaluation Considerations

In setting up a mass vaccination site, there are several aspects to consider across the vaccination journey

	Mobile Clinic	Ad-Hoc / Pop-Up Site Clinic
Operating Model	• Short-term vaccination vehicle that can reach targeted populations	• Semi-permanent structure that is set up to manage and vaccinate large crowds of people
Resource Model	• Engaged community leaders • Small administrative staff that fill several roles • Limited clinical staff	• Large administrative staff with designated roles and surge capacity • Multiple licensed physician and nurse practitioners on-site for emergency management
Technology	• Utilize partner systems for clinic management & reporting • Off-site IT team to assist with data reporting & inventory management	• Supply chain control tower capability • Inventory & Order Management Systems • Automated reporting connected to jurisdiction's IIS system
Clinical Guidance / Emergency Mgmt	• Due to lower volume of vaccinations & transportability aspect, there will not be as many clinical resources / equipment • Identify where closest hospital is for each new location	• Depending on scale and partnerships, additional resources & equipment might be needed on-site to deal with adverse events • Emergency personnel / vehicles should be on-site or on-call nearby
Workflow	• Only a couple of stations that will serve a variety of purposes, which might decrease throughput, but the real focus should be on patient experience	• Objective is to maximize throughput, therefore adequate staff and stations need to be set up in order to prevent & easily mitigate bottlenecks
Populations Served	• Targeted underserved communities that might be hard-to-reach, promoted just within a certain area to prevent overflow	• Mass promotion to all encompassing populations in order to drive as many people as possible to the clinic

Ad Hoc Site - Large

MASS VACCINATION

Mass Vaccination Site Archetypes: #1 – State Fairgrounds

Overview

This pop-up mass vaccination site is situated in a rural part of the state but is located right off one of the major interstates. With hundreds of acres of available land and ample parking, the state dept of health wants this site to serve the surrounding population of 1.2M (within a 50mi radius). However, the closest hospital is 30 miles away, as well as the state's vaccine distribution warehouse, which means the site must be self-sufficient.

Workflow *(Est. Time)*

Entrance / External Gathering Area	Eligibility Screening	Socially-Distanced Waiting Area	Registration	Medical Screening	Vaccine Administration	Post-Vaccination Observation	Exit
0-5 mins	*5 mins*	*0-10 mins*	*3 mins*	*5 mins*	*10 mins*	*15 mins*	***Total: 35-45 mins***

DETAILS

Operating Model

- **Working Hours**: 8AM – 5PM, 7 days/week
- **Site Duration**: 3-6 months+
- **Populations Served**: All eligible persons who come to the site
- **Vaccination Stations**: 8
- **Vaccinated Citizens Produced per hour per station**: 6
- **Estimated Throughput / Day**: 400-500 vaccinated citizens

Resource Model

Resource Type	#
Admin Staff (non-medical)	30
Registered Vaccine Providers	8
Emergency Medical Staff	2
Clinical Staff (RN, Physician, etc.)	2
Other Medical Support (vax prep, post-vax observers, etc.)	8
IT Support	2
Supervisors	2
Security	4

Technology

Site Operations Systems:
- Order management system
- Inventory management system
- Scheduling / registration system

Data Reporting Systems:
- Electronic Health Record System

Jurisdiction / Federal Systems (Interface Required):
- Immunization Information System (IIS)
- VaccineFinder
- Vaccine Adverse Event Reporting System (VAERS)

Jurisdiction / Federal Systems (Access-Only):
- Tiberius System
- Vaccine tracking system (VTrckS)

Clinical Guidance / Emergency Management

On-Hand Resources:
- Emergency support vehicle
- CPR equipment
- Anaphylactic shock medications

Certifications / Capabilities Needed:
- CPR certification
- Conduct and read vital signs (blood pressure cuff, pulse oximeter, stethoscope, etc.)
- Provide supplemental oxygen
- Place i.v. line(s) and administer saline and i.v. medications

Source: American Pharmacists Association (APhA) - https://www.pharmacist.com/immunization-center

Ad Hoc Site - Small

MASS VACCINATION

Mass Vaccination Site Archetypes: #2 – Rural Community Center

Overview

A rural town's hospital has decided to open a mass vaccination site separate from their main facility given the increasing number of COVID patients in their hospital. The site chosen is the town's community center, and it will serve the town and surrounding area's population of ~50k. It is located just a few miles down the street from the hospital and will leverage the hospital's staff and technology systems

Workflow

Entrance / External Gathering Area	Eligibility Screening	Socially-Distanced Waiting Room	Registration	Medical Screening	Vaccine Administration	Post-Vaccination Observation	Exit
0-5 mins	*5 mins*	*0-10 mins*	*3 mins*	*5 mins*	*10 mins*	*15 mins*	***Total: 35-45 mins***

DETAILS

Operating Model

- **Working Hours**: 9AM – 5PM, 5 days/week
- **Site Duration**: 2-3 months
- **Populations Served**: All eligible persons who come to the site
- **Vaccination Stations**: 2
- **Vaccinated Citizens Produced per hour per station**: 6
- **Estimated Throughput / Day**: 100-150 vaccinated citizens

Resource Model

Resource Type	#
Admin Staff (non-medical)	4
Registered Vaccine Providers	2
Emergency Medical Staff	1
Clinical Staff (RN, Physician, etc.)	1
Other Medical Support	2
IT Support	n/a
Supervisors	1
Security	1

Technology

Site Operations Systems:
- *Leverage hospital systems*

Data Reporting Systems:
- *Leverage hospital systems*

Jurisdiction / Federal Systems (Access-Only):
- Tiberius System
- Vaccine tracking system (VTrckS)

Clinical Guidance / Emergency Management

On-Hand Resources:
- CPR equipment
- Anaphylactic shock medications

Certifications / Capabilities Needed:
- CPR certification
- Conduct and read vital signs (blood pressure cuff, pulse oximeter, stethoscope, etc.)

Source: American Pharmacists Association (APhA) - https://www.pharmacist.com/immunization-center

Mobile Clinic

MASS VACCINATION

Mass Vaccination Site Archetypes: #3 – Public/Private Mobile Vaccination Center

Overview

In a partnership with the local pharmacy chain, a local dept of health has decided to launch a mobile vaccination clinic in order to reach populations that are under-represented in vaccine administration. They will engage local leaders and bring the mobile vaccination clinic to a local park to target a specific community of around 1k. They will leverage the pharmacy chain's staff and technology systems.

Workflow

Entrance / External Gathering Area	Eligibility / Registration / Medical Screening	External Waiting Area	Vaccine Administration	Post-Vaccination Observation	Exit
0-15 mins	*15 mins*	*0-10 mins*	*10 mins*	*15 mins*	***Total: 40-50 mins***

DETAILS

Operating Model

- **Working Hours**: 8AM – 5PM
- **Duration**: 1-2 days
- **Populations Served**: Targeted communities / underserved populations
- **Vaccination Stations**: 2
- **Vaccinated Citizens Produced per hour per station**: 6
- **Estimated Throughput / Day**: 80-100 vaccinated citizens

Resource Model

Resource Type	#
Admin Staff (non-medical)	2
Registered Vaccine Providers	2
Emergency Medical Staff	n/a
Clinical Staff (RN, Physician, etc.)	n/a
Other Medical Support	1
IT Support	n/a
Supervisors	n/a
Mobile Center Driver	1

Technology

Site Operations Systems:
- *Leverage pharmacy systems*

Data Reporting Systems:
- *Leverage pharmacy systems*

Jurisdiction / Federal Systems (Access-Only):
- Tiberius System

Clinical Guidance / Emergency Management

On-Hand Resources:
- CPR equipment
- Anaphylactic shock medications

Certifications / Capabilities Needed:
- CPR certification
- Conduct and read vital signs (blood pressure cuff, pulse oximeter, stethoscope, etc.)

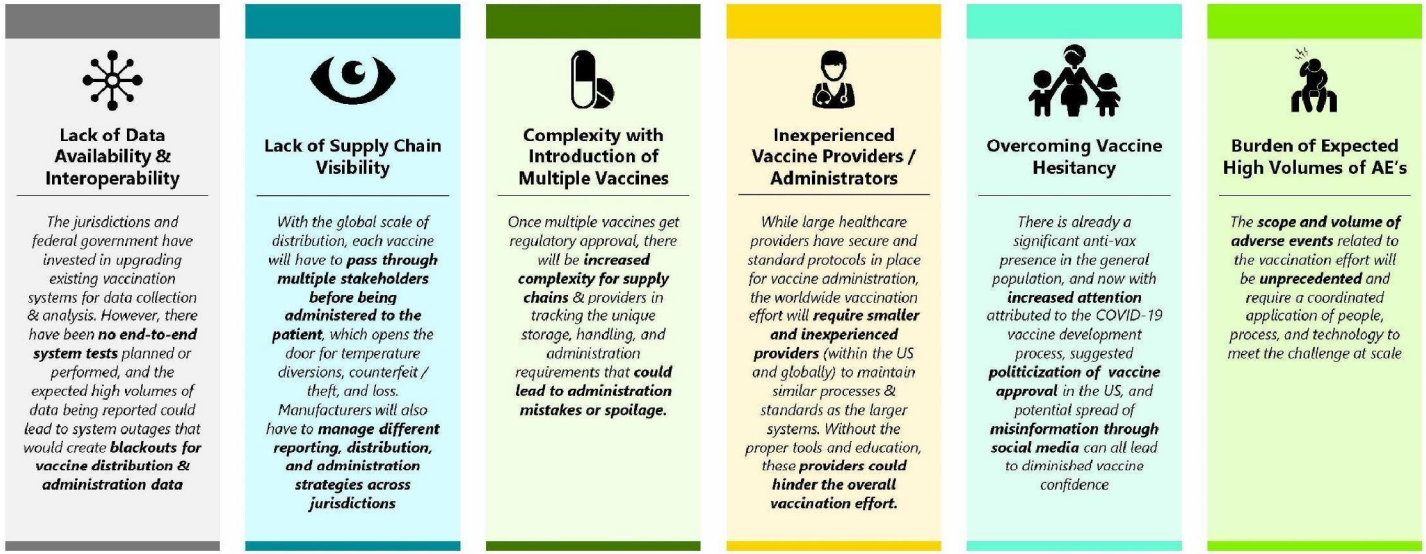
Source: UM Center for Infectious Disease Research & Policy: https://www.cidrap.umn.edu/practice/mobile-vaccination-clinic-reaches-rural-areas


Vaccination Risk Areas

VACCINATION RISK AREAS

There are distinct risk areas for stakeholders across the vaccine ecosystem, and mitigation will require proactive monitoring and close coordination amongst stakeholders

Vaccination Risk Areas



Appendices

Appendix 1:
Vaccination Risk Areas Expanded

Appendix 2:
GovConnect Vaccine Mgmt. Offerings

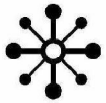
Appendix 3:
Expanded COVID Ecosystem

Appendix 1:

Vaccination Risk Areas Expanded

VACCINATION RISK AREAS EXPANDED

Without a centralized system controlling all aspects of vaccine distribution, the ecosystem will rely on legacy systems that haven't been tested at this scale and can lead to added risk



Lack of Data Availability & Interoperability

The jurisdictions and federal government have invested in upgrading existing vaccination systems for data collection & analysis. However, there have been ***no end-to-end system tests*** *planned or performed, and the expected high volumes of data being reported could lead to system outages that would create* ***blackouts for vaccine distribution & administration data***

What this risk means for…

Vaccine Manufacturers

- Lose ability to forecast demand and plan for allocation & distribution effectively
- Could lead to product loss due to uncertainty around temperature diversions (if loss of cold chain data)
- Delays in distribution due to Test-on-Import process

Healthcare Providers

- Lack of interoperability might lead to duplicative data entries into multiple systems, which might reduce vaccination throughput
- Lose ability to forecast demand and plan for allocation & distribution effectively

Federal & Local Governments

- Public trust in vaccine / government competency could be diminished if data transparency is not available
- Without real-time data key decisions will be made based on a incomplete ecosystem view

How can the risk be mitigated…

Mitigation Strategies

- Set up easy pathways in their technical environments to share data with federal/state systems
- Create a way for federal and state entities to provide manufacturers w/ key vaccine data

Potential Deloitte Solutions

- **Vaccine Administration Management System (VAMS):** Preparing and pushing this solution to states & global stakeholders that are struggling with aggregating and reporting vaccine administration data at-scale
- **AWS Data Exchange**: Enable jurisdictions (US & Global) to leverage this interface to connect multiple systems containing a range of data sets

The global scale of vaccination will require atypical coordination between stakeholders, which makes data visibility an integral element to building trust between participants

Lack of Supply Chain Visibility

*With the global scale of distribution, each vaccine will have to **pass through multiple stakeholders before being administered to the patient**, which opens the door for temperature diversions, counterfeit/theft, and loss. Manufacturers will also have to **manage different reporting, distribution, and administration strategies across jurisdictions***

What this risk means for…

Vaccine Manufacturers

- Brand risk due to spoiled or counterfeit vaccines that are administered
- Product loss risk
- Recall risk

Healthcare Providers

- Without visibility into the vaccine transportation data there might be diminished confidence that the vaccine has been kept at cold chain requirements
- Scheduling complexity in a multi-dose, multi-vaccine environment

Federal & Local Governments

- If the vaccine is not tracked carefully, there are opportunities for counterfeit & loss, which can increase vaccine hesitancy and potentially lead to severe adverse events
- Added complexity for logistics and in creating dynamic allocation models

How can the risk be mitigated…

Mitigation Strategies

- Manufacturers have access to the digital data loggers at provider sites
- Manufacturers placing their own data loggers at the provider sites
- Coordinate across industry players to lobby for data access along the entire supply chain

Potential Deloitte Solutions

- **CentralSight:** Assist vaccine manufacturers, healthcare providers, and federal agencies with identifying where disruptions might occur along the vaccine supply chain so they can take preventative measures
- **ConvergeHealth Miner**: Assist vaccine manufacturers with increased data visibility across the vaccine supply chain by connecting disparate data sources and streamlining data transfers
- **D.SMaRT**: Leverage order data & administration data to support vaccine manufacturers and federal agencies in determining how effective the supply chain is in delivering vaccines from manufacturing site to patients and identify points of weakness

Pharmaceutical companies across the world have taken up the challenge of producing a COVID vaccine, but having multiple players with different products will create additional challenges

Complexity with Introduction of Multiple Vaccines

*Once multiple vaccines get regulatory approval, there will be **increased complexity for supply chains** & providers in tracking the unique storage, handling, and administration requirements that **could lead to administration mistakes or spoilage.***

What this risk means for…

Vaccine Manufacturers

- Demand for one product is displaced by a competitor's product
- Potential for mistakes / confusion in storing, handling, and administrating vaccine

Healthcare Providers

- Additional training & resources will be required for frontline workers to learn the intricacies of each vaccine, which could cause a financial burden

Federal & Local Governments

- Elements of complexity in determining which population group should get which vaccine and how that will change allocation strategy

How can the risk be mitigated…

Mitigation Strategies

- Clear & easy to identify barcoding & serialization
- QR-coding for patients for 2nd dose
- Understanding pros and cons of your products and help inform decisions around which patient groups work best for your product

Potential Deloitte Solutions

- **ConvergeHealth Miner:** Support health care providers in utilizing data to determine which vaccine to administer to certain patients when there are multiple on the market
- **D.SMaRT**: Forecasting COVID hotspots to assist federal agencies (both within US & Global) and local governments with vaccine allocation
- **Medical Information Portal:** Building upon the tool we are developing for the AZ vaccine in Japan, create an app that can be leveraged by both HCP's and patients to easily disseminate information around a particular vaccine – including important tips around administration, common side effects by population subset, and efficacy rates
- **ConvergeHealth Safety:** Signal detection for jurisdictions and federal agencies that will analyze the key drivers (e.g. population subsets) behind adverse events

Vaccination preparation will vary across jurisdictions and provider systems, which makes education that is easy to access and consume even more important

Inexperienced Vaccine Providers / Administrators

While large healthcare providers have secure and standard protocols in place for vaccine administration, the worldwide vaccination effort will ***require smaller and inexperienced providers*** *(both within the US and globally) to maintain similar processes & standards as the larger systems. Without the proper tools and education,* ***these providers could hinder the overall vaccination effort.***

What this risk means for…

Vaccine Manufacturers

- Patient safety risk from mis-administration
- Potential product loss / spoilage

Healthcare Providers

- Liability from utilizing underprepared or inexperienced frontline workers
- Additional resources and training for frontline workers, which can cause a financial burden

Federal & Local Governments

- Equitable allocation might not be possible if provider readiness is an inhibiting factor to allocation

How can the risk be mitigated…

Mitigation Strategies

- Supply global provider education tools that can apply at any level (e-leaflet, e-pamphlet)

Potential Deloitte Solutions

- **Medical Information Portal:** Building upon the tool we are developing for the AZ vaccine in Japan, create an app that can be leveraged by both HCP's and patients to easily disseminate information around a particular vaccine – including important tips around administration, common side effects by population subset, and efficacy rates

DIAGNOSING RISK AREAS – VAX MFGS

Fear around vaccines is high, and it will be integral for stakeholders to communicate a cohesive, transparent message to the public in order to boost vaccine confidence & uptake

Overcoming Vaccine Hesitancy

*There is already a significant anti-vax presence in the general population, and now with **increased attention** attributed to the COVID-19 vaccine development process, suggested **politicization of vaccine approval** in the US, and potential spread of **misinformation through social media** can all lead to diminished vaccine confidence*

What this risk means for…

Vaccine Manufacturers

- Damage to brand reputation stemming from vaccine misinformation
- Decrease overall vaccine demand

Businesses

- Longer timeframe to get back to "old normal", which could limit business growth & impact forecasting capabilities

Federal & Local Governments

- Increased risk for their populations, which could lead to additional cases, hospitalizations & deaths

How can the risk be mitigated…

Mitigation Strategies

- Arming physicians, HCP's, and general public with easy-to-consume information around the vaccine
- Transparency around safety & efficacy of vaccine

Potential Deloitte Solutions

MyPath for Work (Digital Wallet): Support healthcare providers and businesses in tracking employee vaccination to develop strategies around re-opening and expanding in-person operations

Medical Information Portal: Building upon the tool we are developing for the AZ vaccine in Japan, create an app that can be leveraged by both HCP's and patients to easily disseminate information around a particular vaccine – including important tips around administration, common side effects by population subset, and efficacy rates

With the expedited nature of clinical trials and relative novelty of the vaccine, there are expected to be a higher-than-normal rate of AE's that will have to be managed to protect patient safety

Burden of Expected High Volumes of AE's

*The **scope and volume of adverse events** related to the vaccination effort will be **unprecedented** and require a coordinated application of people, process, and technology to meet the challenge at scale*

What this risk means for…

Vaccine Manufacturers

- Product complaints
- Social listening risk
- Negative impact on vaccine uptake

Healthcare Providers

- Resource & system constraints in handling complaints and AE reporting

Federal & Local Governments

- Resource & system constraints in handling complaints, AE triage, and AE reporting

How can the risk be mitigated…

Mitigation Strategies

- Utilize RPA and cognitive case processing
- Leverage insights and signal detection capabilities

Potential Deloitte Solutions

ConvergeHealth Safety

1. Bolster vaccine manufacturer's current PV systems to handle expected high numbers of adverse events related to COVID vaccine
2. Signal detection for jurisdictions and federal agencies that will analyze the key drivers (e.g. population subsets) behind adverse events
3. In combination with Digital Wallet, a consumer-facing, mobile, blockchain based digital wallet to store health information and a set of services to process cases and collect real time insights on adverse events that vaccine manufacturers could leverage

Appendix 2:

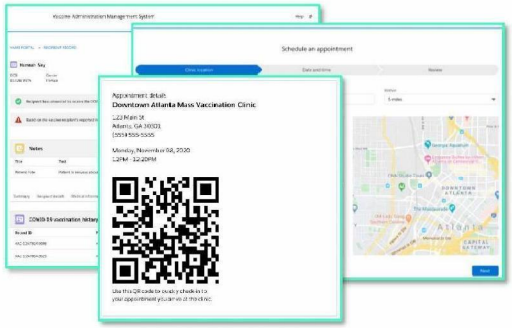
GovConnect

Vaccine Management & Tracking

Deloitte. Digital

GovConnect

Vaccine Management & Tracking



Deloitte's Vaccine Management & Tracking solution, powered by the GovConnect platform, provides a **centralized vaccine management platform** that can help state and local public health officials **manage vaccine distribution at scale and expedite vaccine administration**. The solution is designed to provide **patient self-service and messaging to support contactless registration and communication** with the public, **clinic management to streamline the establishment and operation of points of dispensing (PODs)** by capturing vaccine administration details both online and offline, and **real-time access to vaccine inventory and administration data** to support decision-making. Our platform **compliments and integrates with existing Immunization Information Systems (IIS)** to help states and jurisdictions meet new challenges of mass vaccine distribution.

FEATURES

Patient Self-service and Follow-up Reminders
Recipients can **schedule appointments** with facilities and manage their registration and pre-screening through a mobile-friendly portal to reduce the amount of time that needs to be spent in-person at the vaccination site. **Follow-up engagement for second-dose appointments** and adverse event surveys can be managed through this portal as well.

Client Encounter and Vaccine Administration
End to end **management of Points of Dispensing (PODs)** from clinic and staff onboarding to capturing and documenting vaccine administration. Manage clinic appointments, register and check-in patients, verify recipients, process consent forms, record administration, and generate vaccine certificates using streamlined and efficient workflows reducing patient touchpoints.

Integration with Federal and Jurisdiction Systems
Our system **integrates via an HL7 interface with state Immunization Information Systems (IISs)** to reduce the need for duplicate entry of immunization information. Provider and allocation information can also be generated and sent to federal systems such as VTrckS.

Vaccination Pre-Screening & Program Communication
Education and outreach to critical populations can be coordinated through our system to **provide the public with accurate information including about eligibility** and Emergency Use Authorization (EUA). Additionally, the platform can be used for pre-screening and registration by phased population, inclusive of email and text notifications.

Provider Recruitment and Enrollment
Helps jurisdictions build and maintain a network of vaccination providers by leveraging existing provider networks and onboarding new clinics or Points of Dispensing (PODs) that will adhere to both state and federal conditions of the vaccination program.

Capacity Planning and Allocation
Tools and integrations to collect information about capacity to understand **maximum achievable vaccination throughput** and allocate supply across jurisdictions according to data-driven insights. Our solution can incorporate multiple data sources to provide states and jurisdictions a full picture of conditions in real-time.

Inventory Storage and Handling Dose-level accountability of inventory beginning at the manufacturer or supplier through shipment and administration. Features such as 2D barcoding scanning, site-level inventory management, Lot ID tracking, and real-time updates streamline the process of maintaining vaccine cold chain and ancillary supplies.

Data Analytics & Program Monitoring
Data can be aggregated from our solution and reported to multiple internal and external stakeholders to meet the strict 24 hour reporting guidelines for vaccine administration. Additionally, data modeling and integration of social drivers of health data can **identify populations and geographies for priority vaccination event**s.

BENEFITS

- Offers integrated **Cybersecurity and Privacy**, enabled by Deloitte Cyber.
- Offers public health officials **insights to guide strategy and policy** through evolving vaccination guidelines
- Provides a **comprehensive view** of the vaccine supply and demand.
- **Mobile-ready interfaces** for both patients and clinics with capability for **offline support**.
- **Modular design** allows features to **integrate with existing systems** while reducing duplicate entry.
- Increases **operational and full situational awareness** with clear reporting of data across various sources.
- **Reduces manual effort** by incorporating process automation.
- **Reduces burden** of data collection for health staff and improves accuracy of self-reported data.

Vaccine Pre-Screening Site(VPSS)

Individuals across the US are seeking information to the question "When can I get vaccinated"? Deloitte's Vaccine Pre-Screening Site enables individuals in a jurisdiction to answer a few simple questions and then receive information about whether they are currently eligible for a vaccine in their jurisdiction. Deloitte's solution enable States to build confidence in vaccine distribution efforts, build demand for the COVID-19 vaccine and clearly communicate to individuals in a state if they are eligible for the COVID-19 vaccine.

Jurisdiction-Specific

States can easily tailor vaccine eligibility guidelines, questions, and data collected to fit their jurisdiction-specific needs. States can also seamlessly update these guidelines (whether by age, employment, health condition, or more) as they refine their protocols.

Scalable Platform

The Vaccine Pre-Screening Site is offered on a scalable, configurable, and interoperable platform where it can be hosted in a State's tech stack and cloud provider of choice.

Flexible User Registration

Users can register in the Vaccine Pre-Screening Site (VPSS) without creating an account. States can opt to add user authentication, allowing users to be uniquely identified. Authentication also allows users return to check on their status

Standalone or Integrated with Existing Systems

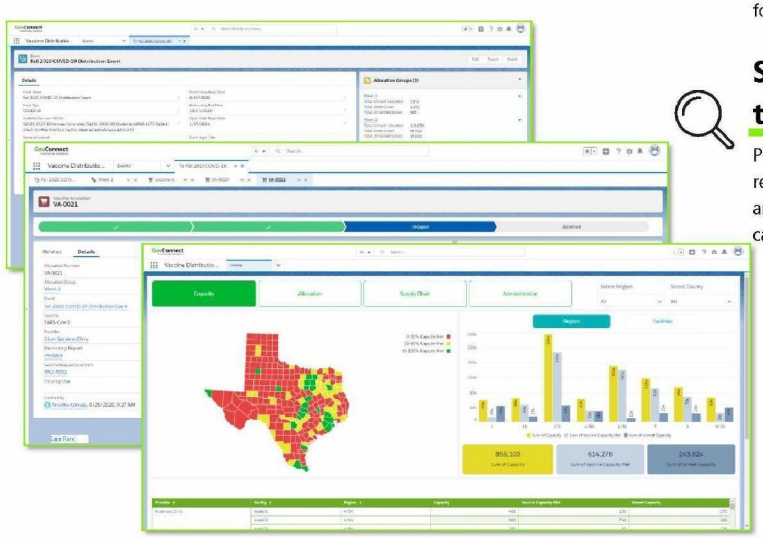
States have the option of implementing the Vaccine Pre-Screening Site as standalone site or it can be connected to the State's existing registration and scheduling systems.

Additional Features

The Vaccine Pre-Screening Site offers opportunities for increased communication with users though email or text notifications, may include logic to estimate timing based on questions answered, and offer links to public information resources. Contact center integration is also optional for jurisdictions who wish to add enhanced communication options.

Vaccine Management & Tracking (VMT)

Deloitte's solution provides states with visibility into multiple dimensions of the vaccine supply chain, from forecasting demand through provider pre-booking through allocation, shipment, receipt, and administration at facilities.



Flexible administration

State health departments can organize centralized vaccine distribution efforts using demand forecasting to allocate limited supply.

Scalable platform

Built on a scalable, configurable, and interoperable platform, modules can be enabled within our solution or integrated with existing state supply chain infrastructure.

Statewide transparency

Providers and facilities are able to report real-time updates to supply and demand to inform strategic capacity planning and allocation.

User-driven flows

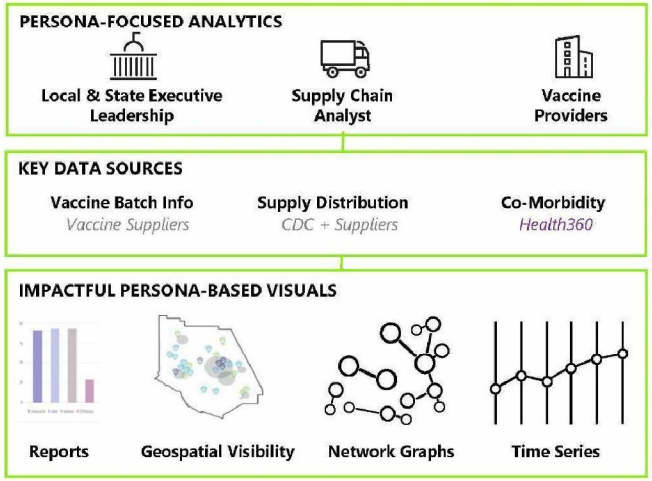
User-centric screens allow for clear and direct execution of optimization strategies across multiple stakeholders.

Inventory management

Vaccine stock can be tracked from initial demand through the supply chain to administration, maintaining accountability of each dose back to the supplier.

Vaccine Analytics

Vaccine Analytics pair vaccine information and supply chain data with external data sources to provide **deeper insights** into how vaccines are distributed across geographies, where **vulnerable populations are located**, and how to **deploy health resources to drive greater impact**. The result is persona-focused analytics that drive insight into every level of vaccine distribution for a population.



Visualizing Vaccine Demand

See what populations have been vaccinated, where current need resides, & how to strategically surge support for that demand.

Understanding Vaccine Sentiment

Using behavioral analytics to examine the "how's" and "what's" of a vaccine consumer to learn how to **optimize vaccine usage.**

Helping Vulnerable Populations

Overlay **predictive risk scoring** from our **external data sources** to focus attention on providing vaccinations to vulnerable populations.

Increasing Service to Citizens

Enable **residents in need** of social or economic support to **access assistance programs and find resources.**

Supply Monitoring & Distribution

Monitor current vaccines how vaccination are distributed across geographies and populations.

Emergency Management Operations

Deloitte's crisis management practice can help you anticipate, react to, and avoid potential risks resulting from a large-scale vaccination distribution effort as critical as COVID19.

Social Media Intelligence

Deloitte's Blab technology employs a process focused on statistical analysis classifying social content into relevant to specific topics, themes or personas to discover unexpected trends not accessible through traditional search techniques. Our solution engine then statistically builds its own conversation trend ontology that guides the real-time machine learning processes to **discover and predict the shifting patterns of actual discussions**. By using the technology, you can **respond with more precision** and **rapidly mobilize** on prospective threats and opportunities. You can be better positioned to take informed, strategic action.

Strategy, Governance & Interagency Coordination

Institute governance structures, central coordination, protocols, and emergency actions.

Develop communication strategies using Social Media Intelligence and other techniques to increase situational awareness and coordinate multi-agency response.

Compliance Monitoring

Establish a compliance office to manage fiscal, operational, and risk monitoring of vaccination distribution operations.

Provide flexible surge staffing for distribution hubs to manage logistics and compliance

Prepare compliance reporting for relevant agencies in compliance with Federal reporting guidelines.

Risk Assessments

Identify and prioritize risks associated with vaccine distribution and leverage benchmarks from large scale vaccine distributions in the past to recommend leading practices

Funding Management

Define funding strategy to support distribution operations

Evaluate federal funding opportunities and underlying eligibility criteria to minimize impact to state/local budgets

Establish financial controls to track distribution costs and maintain compliance over federal reporting requirements

Contingency Planning

Plan for alternative vaccine storage, transportation and handling scenarios.

Analyze population vulnerability to prioritize vaccine distribution

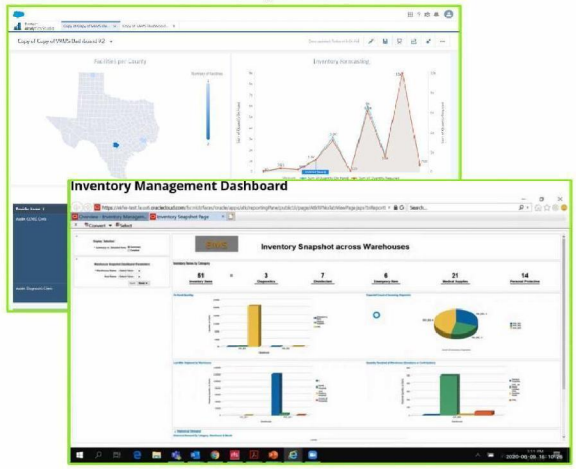
Wargame to prepare for operational and logistical challenges

Reporting

Define Key Performance Indicators to continuously assess and report the efficacy of distribution operations and proactively address potential risks of disruptions or other adverse events

Emergency Management Operations

Deloitte's Vaccine Supply Chain Management Solution integrates end to end supply chain processes from demand planning and order capture to procurement and inventory distribution. Our solution leverages advanced barcoding technology for tracking functionality and offers robust reporting capabilities to view supply, demand, and forecasts at the state, local, and facility levels



Demand Planning

Aggregate demand from online vaccine pre-booking and provide the drill-down capability to examine demand in region and local level

Order Capture

Conduct order in-take from regional and local level and acknowledge order receipt

Inventory Management

View inventory and place replenishment requests to external suppliers or initiate inventory transfers within the network

Receiving Inspection

Orders received into the system can be inspected using mobile scanning devices to enable returns due to damage or spoilage

Mobile Scanning

Mobile scanning and barcoding to track and manage inbound and outbound inventory movements

Easy Reporting

Analyze on-hand inventory, demand and replenishment orders across distribution network with drill-down capability for additional granularity

Integration

Seamless and streamlined integration across full end-to-end supply chain from demand planning, order capture to inventory management.

Advertising, Marketing & Commerce

Deloitte knows how to get ideas exactly where they need to be. We create **public awareness campaigns that inspire audiences to take action**, which is exactly what they will need to do once a COVID-19 vaccine becomes available. Our campaigns focus on **analyzing audience data** to inform our **strategic and creative approach** to get audiences the *right* information at the *right* time and in the *right* context.

Sample COVID-19 marketing campaign creative

Data-driven analysis

Mine data and look at public health data sources, systems, and processes to determine outcomes we want to achieve or avoid, and inform how to create deep emotional connections with your audiences.

Market research

Conduct primary and secondary research, using artificial intelligence, surveys, and crowdsourcing tools to predict where the market is going, and uncover themes that can help make vaccine messages meaningful.

Customer experience modeling

Evaluate the values, beliefs, and ambitions of your organization and the people you serve. We apply qualitative and quantitative human-centered principles, concepts, and methods to determine how to elevate the human experience.

Campaign planning and implementation

Create measurable goals and objectives for a vaccine marketing campaign, using data-driven analysis and market and customer insights. The campaign strategy includes the key messages, tactics, partnerships, and creative required to effectively communicate about the vaccine. A go-to-market pipeline is created to schedule and manage the delivery of all tactics.

Evaluation and optimization

Assess the success of the campaign, tied back to benchmarks and performance measures. Evaluation of what was effective, and what was not, will be determined, with recommendations on how to pivot communications for increased market penetration.

Contact Center

Deloitte's contact center practice provides tiered support and a wide range of technologies to help you manage the inflow of contacts leading up to and during vaccine distribution.

Customer engagement platform

Agent Assisted – Tiers 1, 2, 3

Tier 1, remote agents can be quickly ramped up to answer basic questions about vaccine availability and eligibility

Tier 2 agents can support more complex queries and requests in a timely manner

Adding additional tiered support, scalable to your needs, prevents disruption to your current workforce

Chatbot & Voicebot (IVR)

Bots provide self-service options to resolve inquires and less complex tasks, eliminating the need for agent intervention.

Interactions that these channels are unable to answer are routed to the next available and properly trained agent.

Outbound Calls / SMS

Reduce inbound interactions by preemptively delivering information with residents through outbound calls, SMS, email, etc. based on a Next Best Action Model.

Messaging may be generic or tailored to each recipient

Omni-channel Technology

Integrating multiple communication channels provides a flexible and seamless customer experience.

An omni-channel technical solution that allow for "customer choice" when it comes service

Vaccine Management for the Long Term

Immunization Information System (IIS)

Deloitte's Immunization Information System (IIS) delivers a holistic solution for immunization tracking, addressing routine vaccinations, individuals' vaccine history, and targeted, mass vaccination campaigns. This solution provides a modern, scalable immunization registry for vaccine administration, and the exchange of information regarding these vaccines.

Tracking and Reporting

Patients and their families, schools, and healthcare providers can search and manage a consolidated view of the patient's immunization history, across geographies and vaccine administrators

Data Exchange

Records are shared among providers, state and local health jurisdictions, and the CDC using common connectivity protocols and CDC guidelines

Consolidated Inventory Management

With access to a common inventory system, healthcare providers, and state and local health jurisdictions can manage supply and demand to meets needs across the geography, with based on consistent and timely information

Data Insights

States can access data analytics and visualizations for effective monitoring, inventory forecasting, and outreach planning

Implementation Toolkit

The IIS toolkit provides a planning roadmap, a data migration strategy and approach, data exchange accelerators, a cutover strategy and approach, and post-go live support recommendations. It also includes tools for configuring the types of vaccinations that can be managed within the registry and relevant decision support rules.

Strategic Communications & Implementation

Deloitte's solution includes **targeted workforce pulsing** and a **communications tool kit** to engage Stakeholders and drive knowledge sharing. Additionally, an **implementation toolkit** enables the engagement of providers and facilities to drive the implementation of the State's objectives. **Workforce analytics** sizes and scales the workforce **for maximum productivity**.

Stakeholder Engagement

Analyzes the level of impact, influence and engagement of each stakeholder group impacted by the Vaccine. Establishes a baseline of stakeholder concerns, critical success factors and activities to filter out the noise.

Knowledge Sharing

Develop informative materials that respond to current events captured through social sensing. Deliver knowledge quickly while covering critical information on technology and process updates/changes.

Workforce Pulsing

Facilitates data collection through pre-built modules that quickly, but efficiently capture workforce sentiment. Outcomes include actionable insights collected directly from the workforce that can be used to inform service delivery plans and communications.

Communications Toolkit

Provides a roadmap and strategy for workforce and citizen communications through social media and other Government employee communication platforms. Includes support for developing communications based on real time data and information.

Implementation Toolkit

Provides a roadmap and strategy for engagement with providers and facilities to drive implementation of the State's objectives. Includes implementation planning and execution support (command center and Site Support)

Workforce Analytics

Provides a framework to calculate the number of required vaccine management workers and establishes objective capacity- and productivity-thresholds to forecast future workforce changes.

Countering Mis-, Dis-, Mal-information (MDM)

The research, development, and distribution of vaccines are critical for safeguarding public health and reducing infection and fatality rates. Mis-, Dis-, and mal-information narratives related to COVID-19 (and other viruses)—should they reach critical mass—could threaten the ability to protect the public. As a result of MDM, individuals might lose confidence in the safety of a vaccine or take refrain from protective measures, including vaccination.

Deloitte's solution features a team of multi-disciplinary, multi-lingual analysts who use data analysis tools to **help client's sense, assess, and respond to risks posed by MDM.** The solution's outputs can integrate with planning, communications, and response efforts to improve decision-making, mission outcomes, stakeholder engagement, and strategic communications.

Sense

Social Sensing

Track changes in observed discourse on relevant topics and sub-topics to identify emerging risks, including those impacted by mis-,dis-,mal-information narratives.

Near Real-Time Alerting

Collect information across multiple data platforms to identify and alert on new and emerging MDM narratives in near real-time

Assess

Risk Analysis

Asses who is disseminating MDM, how, and why, to determine potential risks to mission, reputation, and safety.

Impact Reports

Identify -target audiences, including why and how they are being targeted to provide insights into the likely impact of the MDM on real-world events.

Respond

Tailored Insights

Provide tailored insights aligned to client's roles and authorities — from the executive boardroom to the analyst — in support of response efforts, strategic planning, enhanced risk management, and actionable decision-making

Recommendations and Remediation

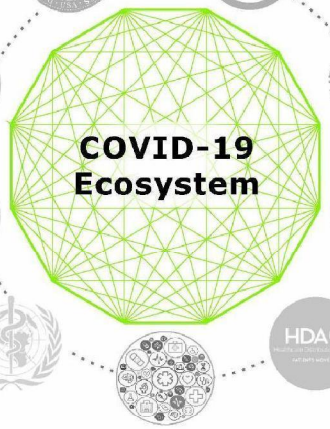
Provide customized recommendations for strategic remediation responses to combat MDM narratives and campaigns including, but not limited to, stakeholder engagement and tech sector outreach

Appendix 3:

Expanded COVID Ecosystem

APPENDIX

Deloitte's participation in the COVID-19 Ecosystem



US Health & Human Services / Centers for Medicare & Medicaid

COVID-19 Response Planning for Office of the Secretary of HHS

Multiple US States COVID-19

Project management, information technology and analytics for COVID vaccines distribution

US Food & Drug Administration

Numerous engagements that support COVID-19

National Institutes of Health

Management and scientific agenda of partnerships to find COVID vaccines / treatments (ACTIV PPP)

US Centers for Disease Control

Testing informatics strategy and expanded reporting, analytics & decision support; **Vaccine distribution and administration management** system development

Gates Foundation

PMO support for **the COVID-19 Therapeutic Accelerator (CTA)**, which includes 18 pharma companies to manage the collaboration goal to accelerate treatments, vaccines, and diagnostics.

World Health Organization

Development of the COVID-19 Knowledge Hub allowing countries to **monitor health, economic, and social indicators and review the impacts** of ongoing modulation of restrictive measures

Distributors

Research/scenario planning for biopharma finished goods supply chain

Pharma COVID-19 Response

Supporting **multiple bio-pharma commercial and supply chain teams**

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