

The Value and Impact of Sustaining Strong Immunization Information Systems in the Age of COVID-19

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Abstract

The SARS-CoV-2 pandemic has highlighted the need for real-time epidemiologic information, particularly surrounding mass immunization campaigns. Pandemics, by their very nature, accelerate the public's interest and concern for safe and effective vaccines. Science, policy, and politics all share a common need during global pandemic response—the need for information. Historically, the healthcare system surrounding immunizations has recognized this need and developed patient registries to monitor vaccine uptake. Commonly known as Immunization Information Systems (IIS), these registries are designed to aid public health departments identify gaps in coverage, design education campaigns, and implement immunization drives, to name a few. We provide an overview of the capabilities of IIS, with special emphasis on how these technologies can be used to support the COVID-19 vaccines.

Keywords: Covid Vaccine; Immunization Information System; Immunization Intelligence; Vaccine-Preventable Disease; Outbreaks

Background

Immunization is one of the most potent public health tools we have at our disposal to combat preventable diseases. Understanding immunization coverage rates in populations, knowing who is at risk geographically and where communities or subpopulations live that are under-immunized are just a few of the uses of immunization information. Information is important for good public health vaccine-preventable disease practice.

There exists today health information technology that supports the data collection of patient immunization events. These events are reported from the patient's provider and health care community into health technology systems that consolidate these records into a single patient's immunization history. The systems are commonly referred to as Immunization Information Systems (IIS).

In the United States, they have evolved over the last two decades into registries that collect a significant amount of patient data through the electronic information exchange between provider clinical electronic health records (EHR) systems, pharmacy management systems, and systems designed to support mass immunization events. The IIS data has reached a point in many locations that well over 90% of the area population will have at least one record in these registries.

The current pandemic and the race for a new vaccine is nothing new for the immunization community and ecosystem or the users of the IIS. Over the years new diseases have emerged such as Zika, or re-emerged, measles outbreaks and in each case, the immunization

community has used data and information to manage and mitigate the impact of these occurrences. New vaccines have been developed for Cancer and Shingles targeting immunization gaps in at-risk populations. As such the new COVID-19 vaccines soon to be launched is just the latest example of how research and new vaccine development once approved for utilization requires the collection of data to track, monitor, and measure impact. Notably public health professionals must account for vaccine orders, monitoring cold storage and delivery. They must track individual patient immunizations to ensure dose accountability, provide outreach to ensure patient series completion, and monitor and report adverse effects. The technology to support these requirements and the data collected through this process is designed to support decision-making through the use of analytics which is the basis of Immunization Intelligence™ that empowers the users of this data to influence and inform.

A new Covid-19 vaccine can be thought of as simply another day for the vaccine-preventable disease community. But there is one difference. Covid is a global pandemic. The virus has far-reaching impacts beyond a select few who are at risk for the more common VPD diseases. The same information process and systems are required to support Covid but now Immunization Intelligence™ is needed in real-time. Public pressure to understand and “know” translates to political pressure to act or react. The value and impact of sustaining and expanding IIS at this point rest on the value they offer to provide this real-time information.

Today it is possible to combine specific patient and vaccine information with other key health data assets. This accelerates the possibility for communities to better understand and facilitate equitable allocations of vaccines, provide policymakers with situational information to inform the public and guide response efforts. The IIS is designed to provide real-time, rolling estimates of population-wide coverages eliminating the need for traditional data collection surveys or secondary data collection processes relying on data such as that supporting billing. Though less important for public health planning efforts that take place over many years, the lack of real-time data prohibits rapid public health responses. A particularly relevant example is the forthcoming deployment of SARS-CoV-2 vaccines [1].

Unmatched in the Covid vaccine speed of development and the dose-volume needed for distribution, deploying these vaccines present logistical and public health challenges for which established, technical solutions are needed. Not only do planning efforts need to account for preliminary needs but they also need to monitor and respond to shortages and gaps in coverage, particularly among those most at risk for serious illness or death due to COVID-19. Studies that rely on survey design-from which most immunization coverage rates are estimated-are not designed to provide the real-time, population-level data needed to address the challenges of this or any global pandemic.

Traditional surveys to help estimate coverage rates are not antiquated, but they can be resource-intensive and require scientists to account for potential sampling bias. Even with post hoc adjustment for factors known to be associated with sampling or recall bias, it is likely that some amount of uncontrolled bias remains. IIS is not without limitations, but if any reporting bias by providers was of lesser magnitude than sampling or recall bias of survey respondents, IIS could arguably be a better method of capturing the true, population-based coverage of a given vaccine to include Covid.

Using IIS for these purposes, especially during a pandemic, needs to be approached with knowledge of their limitations. First, IIS relies on vaccine providers reporting immunization events to their respective state registries. While reporting mandates exist for some vaccinations, regulations vary by jurisdiction. Second, to be included in an IIS registry, data submissions must meet certain quality controls. This presents challenges for data cleaning, though recent developments using artificial intelligence show promise for improving quality efforts [2,3]. The practical result of both limitations is likely an underreporting in the coverage rate for a given area. Additional research needs to determine what factors underreporting or data quality issues occur so that educational and interventional efforts can be implemented.

One of the factors unique to a pandemic versus a traditional outbreak such as is Mumps is the need to plan for and manage mass immunization events. These events require robust technology solutions that can capture patient events quickly and provide data in real-time so that public health can plan, implement, evaluate, and react to distribution challenges. Maximizing immunization coverage and reducing

disparities, not only for a pandemic pathogen like SARS-CoV-2, benefits the broader community by helping to reduce the burden of infectious disease, ultimately leading to a healthier population.

The value and impact of an IIS in the age of COVID-19 can be illustrated by several examples. Examples that illustrate the value of the data to the decision-making process. With the new COVID-19 vaccine it will be important for the public health and regulatory communities to understand details on who is receiving these vaccines, what is their current status for multi-dose options, adverse reactions that may occur, and what are coverage rates for high-risk populations or the hard to reach subpopulations. As the new vaccine becomes available and the uptake of this in populations has monitored the information to answer these questions will begin to come together rapidly.

To highlight what might be expected and how data may be used can be illustrated in a few case examples using data retained in IIS deployed in U.S. public health agencies and pharmacies.

An illustration of immunization data volumes in pharmacy immunization programs

STChealth operates a National Immunization Data Exchange in the US. This exchange electronically connects individual pharmacy locations across the country to over fifty (50) centralized IIS, typically in a U.S. state public health agency. As of January 1st, 2020, 42,486 pharmacies have reported 615,563,186 patient immunization events¹ to these centralized registries. The data captured includes the patient demographics, vaccine given, and dose. It includes the provider, vaccine manufacture, and date and times. These detailed records are sent through secure connections and merged with patient records within these centralized systems. Pharmacies are most often immunizing adolescents and adults. When the data scientist examines this information geographically and compares it to populations in the area it is possible to examine the overall coverage rates and evaluate population risk factors to VPD.

The following table captures for two geographical areas in the U.S. the total pharmacy immunizations reported in this above time frame along with the top ten immunizations given across the region as reported to an IIS. As one would expect the flu immunization numbers are prevalent. Pharmacies focus on their flu program but the real return for a pharmacy immunization program and their patient loyalty is provided by their closing immunization gaps, which an IIS is designed to support while the patient is at the point of care.

Rank	Vaccine Group	Total	Percent	Vaccine Group	Total	Percent
1	Flu	292,076	21%	Zoster	1,083,174	18%
2	Zoster	287,376	21%	Flu	1,082,162	18%
3	TDaP	121,466	9%	TDaP	582,556	10%
4	PneumoPPV	117,706	8%	PneumoPCV	515,304	9%
5	PneumoPCV	113,100	8%	PneumoPPV	504,770	9%
6	HepB	105,251	8%	HepB	463,554	8%
7	HepA	96,791	7%	HepA	441,934	8%
8	MMR	87,626	6%	HPV	409,044	7%
9	HPV	86,216	6%	MMR	406,928	7%
10	Menng	83,584	6%	Menng	399,200	7%
Totals		1,391,192	100%		5,888,626	100%

Table 1: Pharmacy immunizations reported to two-state IIS January - November 2020.

¹STChealth LLC Pharmacy Immunization Reporting Data Summary 1/1/202 – 11/1/2020

By using this current pharmacy immunization practice and reviewing the large numbers of immunization being given it is expected that the Covid-19 vaccines will become a key component of these programs. The pharmacy electronic connections to an IIS will be important to support decision-makers as they monitor and manage this outbreak and population risks.

An illustration of immunization series completion rates using data from registries

Several manufactures that will launch their Covid-19 vaccine will utilize a two-dose series. The importance of ensuring the patient receives the second dose in a timely fashion after the first will significantly increase the efficacy of the vaccine. The ability to monitor patient outreach to encourage uptake of the second Covid dose is the same as current multidose vaccines and again the IIS plays a key role in this process.

An example, a multiple-dose vaccine is a vaccine for Pneumonia. The multidose Covid vaccine may exhibit similar uptake challenges. Understanding current vaccines similar will help public health and pharmacies to develop outreach and education programs to influence individuals to return for dose 2. As an example, the series completion rates for a multidose pneumonia vaccine from data within eleven U.S. central IIS is illustrated in table 2. There are regions with completion rates from 69.54% to 85.11%. Neither should be considered acceptable for the Covid vaccine.

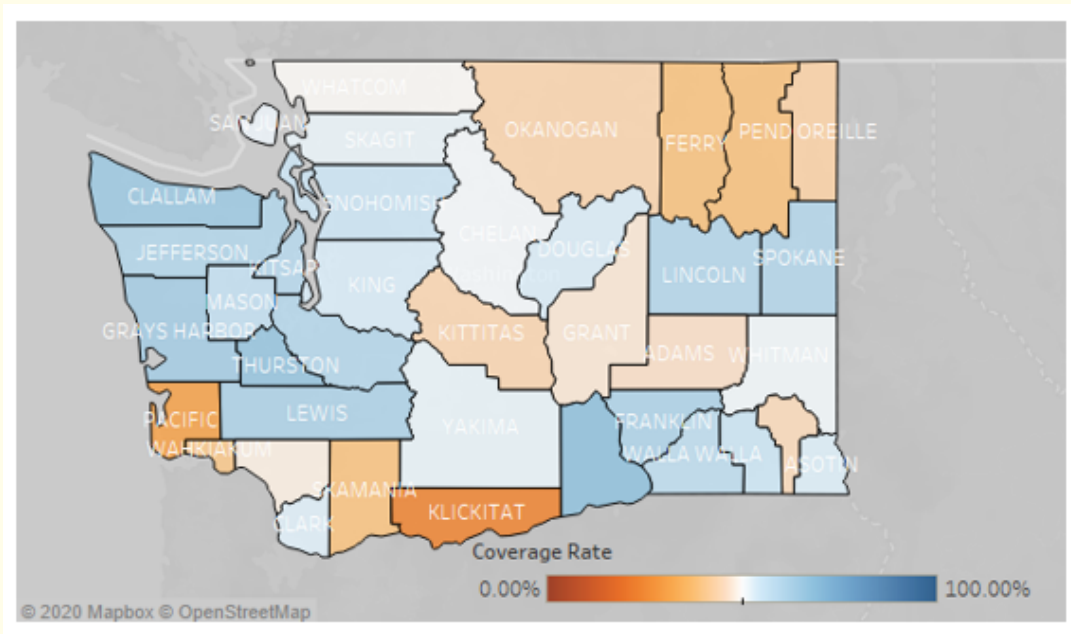
US Region	Received Dose 1	Received Dose 2	Series Completion
1	4,976	4,235	85.11%
2	6,298	5,508	80.31%
3	7,976	6,702	84.03%
4	14,743	10,252	69.54%
5	29,253	24,912	85.16%
6	47,133	39,111	82.98%
7	54,148	43,407	80.16%
8	62,143	49,447	79.57%
9	62,728	51,974	82.86%
10	68,800	50,795	73.83%
11	83,987	68,138	81.13%
Total	442,185	354,031	80.06%

Table 2: Pneumonia coverage completion rates.

The data presented in this table was generated by monitoring individual patient vaccine histories. Having this detail available to a provider or pharmacist supports their outreach to remind individuals of their second dose and to schedule appointments and follow-up. This capability and the value of this data for the new Covid-19 multidose vaccines will be equally as important.

An illustration of immunization coverage rates using data from registries

A third example of the value of immunization information systems in the era of Covid can be illustrated by reviewing efforts associated with Flu rate coverages. The following figure is a geographical representation, in this case, Counties within the State of Washington in the U.S. It specifically is a visualization of adults of the age of 65 who received their influenza immunization in the most recent 2019 - 2020 flu season. Counties that are in the blue category have to hire coverage rates.



With the Covid-19 vaccine by using data reported to an IIS, this type of visualization will provide senior public health officials with a real-time situational assessment of the overall progress to protect the populations. The data behind this visualization is again detailed patient records rolled up geographically. By combining this information with population demographics, such as census data it is also possible to quickly assess subpopulations’ potential being underserved.

Summary and Conclusion

A new Covid-19 vaccine is like any new vaccine entering the market. The difference being in the public and governmental attention to the uptake of this vaccine as it becomes available. There is a call for improved information and more rapid data tracking and collection. This is one value for investing and maintaining Immunization Information Systems. Their use in the U.S. is extensive but not perfect. The new vaccine and its impacts on the vaccine ecosystem will be significant and it will be the reports that are developed a year or two from now that will provide the key lessons learned and offer insight into how important these information systems were used to support the vaccine roll-out in this pandemic. And that will give us the insight to continue to evolve these health data assets to be better aligned for the next pandemic.

Globally immunization systems will become more important and no information system can substitute for proactive provider efforts and outreach to their patients. But these systems can be of great value to assist in closing gaps in care for populations, maximizing limited resources, and integrating with other key health data sets that create the type of interoperable health record systems required today.

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