



A Proposed Framework for Cloud Immunization Information System: Challenges and Opportunities

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Abstract. Immunization and vaccination do not exactly mean the same thing. The term “vaccination” refers to receiving a vaccine, which includes receiving the injection or oral dose. Immunization is the process of receiving the vaccine and developing an immunity to the disease after receiving it. By compiling immunization information into a single trustworthy source, Immunization information systems (IIS) assist healthcare professionals, families, and public health officials. The data can then be utilized to enhance vaccination rates, direct patient treatment, and ultimately lower the incidence of diseases that are preventable by vaccination.

This paper seeks to identify the immunization information systems (IIS) concept its functions, clarify why it is important, propose a framework of cloud Immunization information systems, discuss the levels of this framework and its goals, challenges, and opportunities.

Keywords: Immunization Information System · Cloud Computing · Electronic Immunization Registries

1 Introduction

The gathering of complete population-level immunization data is fraught with difficulties. Immunization administration is spreading out more and more. People can now get vaccines from a variety of healthcare professionals, such as primary care doctors, public health officials, and pharmacists.

Additionally, the increased cross-border migration of people raises issues with the exchange of immunization data between public health jurisdictions. Therefore, to gather and aggregate immunization data, effective immunization programs are becoming more and more dependent on the involvement of citizens, healthcare professionals, and public health officials. A potential solution to some of these problems is offered by internet and mobile technology [1].

To increase and enhance vaccination distribution in Egypt, one tactic that might be used is the use of a Cloud Immunization Information System (CIIS).

Access to consolidated immunization history records, which include details on all immunizations a person has had from providers that report to the IIS, is made possible by IISs for authorized users, such as patients and clinicians.

Public health organizations often use aggregate IIS data to track and assess vaccination trends in specific regions. IISs can help with additional public health tasks like managing vaccination supplies, automating vaccine reminders, and responding to infectious disease outbreaks [2].

1.1 Distinction Between Electronic Immunization Registries (EIR) and IIS

EIR and IIS are frequently used interchangeably in the literature. It is necessary to make reference to other widely used phrases in order to differentiate them from one another and create clarity [3].

A recorded history of vaccinations is referred to as an immunization record. The following is a suitable definition of a vaccination record:

Records of vaccinations, often known as immunization records, give a history of all the vaccinations you or your kid have had. This record might be necessary for applying for specific jobs, travelling overseas, or enrolling in school. This is equivalent to a physical vaccination card for an individual, and it relates to paper-based nominal registers or records for a community. Any immunization program's foundation has always been its vaccination records, which enable the documentation of the vaccination event [4]. An electronic immunization record is a written record of immunization history that has been digitalized. Improving individual and societal vaccination is made possible by having immunization records in electronic form.

In a database, electronic immunization records are compiled. An electronic immunization registry is the term used to describe this collection of data [5]. Records and databases should not be confused with the range of possible functions that go along with them. Some of these features will also permit the registration of additional information about individuals, such as age, sex, profession, or risk factors, in addition to vaccination history, while other features permit the inclusion of additional information, such as a vaccine inventory function to simplify vaccine ordering. Then, an immunization information system could include electronic immunization registries.

Clinics, hospitals, pharmacies, schools, child care facilities and public health who uses IIS [7].

1.2 Purpose of Immunization Information System

The tangible advantages it offers to stakeholders and the abundance of chances it presents are the finest ways to illustrate an IIS's mission [8].

Immunization campaigns are intricate public health initiatives that have a significant positive impact on health. They are susceptible to shifts in public perception and confidence. Recent controversy surrounding vaccination programs has hindered vaccination uptake for some vaccines. It is necessary to quickly provide real-world evidence of the effectiveness and great safety profile of immunizations in order to resolve this issue. IIS are a crucial instrument for promptly documenting the advantages of immunization

for health. When laws protecting data security and privacy are in place, technological advancements have made it possible to create an extensive national IIS.

The following are some examples of a comprehensive IIS's general goals are to offer data to help with operational decisions, to support the administration of the vaccination program at the point of administration, to enable instant access to personal immunization records, and to provide data that will help decision-makers make more informed strategic choices, and to preserve and make available access to reliable statistics on immunization and the general population [9].

1.3 The Need for an Immunization Information System

IIS development and design take into account both individual and societal demands.

IIS capabilities enable clinical decision assistance at the point of care, customized vaccination advice, and the creation of immunization reports at the individual level.

IIS supports supply chain management, safety monitoring, reporting, and monitoring of vaccine coverage at the population level (for instance, at the district or national level). This makes it possible to monitor and assess the success, impact, and effectiveness of services.

The capabilities of IIS are expanding beyond simply recording vaccinations and toward the inclusion of advanced features, such as personalized information on vaccination, a communication platform that enables targeted communication towards healthcare professionals and the general public, decision support systems for vaccine providers (such as automated protocols for vaccination catch-up), recording of reasons for vaccination refusal, and a communication platform [6, 10].

The Immunization Information System (IIS) Function outlines the operations, data quality, and technology required for IISs to serve vaccination programmes, vaccination providers, and other stakeholders in the field of vaccination. Some of the IIS's features such as: Provide Healthcare Effectiveness Data and Information; Exchange data with Medicaid programmes; Assess coverage by geographic region; Conduct centralised reminder/recall; Provide public access to IIS portal; Exchange data with other regions. Support patient look-up and vaccine tracking for mass vaccination. Use IIS to conduct emergency preparedness activities [11].

2 The Proposed Framework

In this section, we outline a proposed digital platform that would enable people to take control of own immunization data and share them with others via cloud computing. The framework under consideration is a cloud-based immunization record that could assist in bridging jurisdictional gaps in the flow of immunization data by giving people easily shareable, standardized digital copies of their records (Fig. 1).

As shown in the proposed framework, it consists of different phases as follows:

2.1 Cloud Infrastructure

These hardware and software components' characteristics and functionalities are covered by the cloud infrastructure. After that, a cloud service provider or, in the case of a private

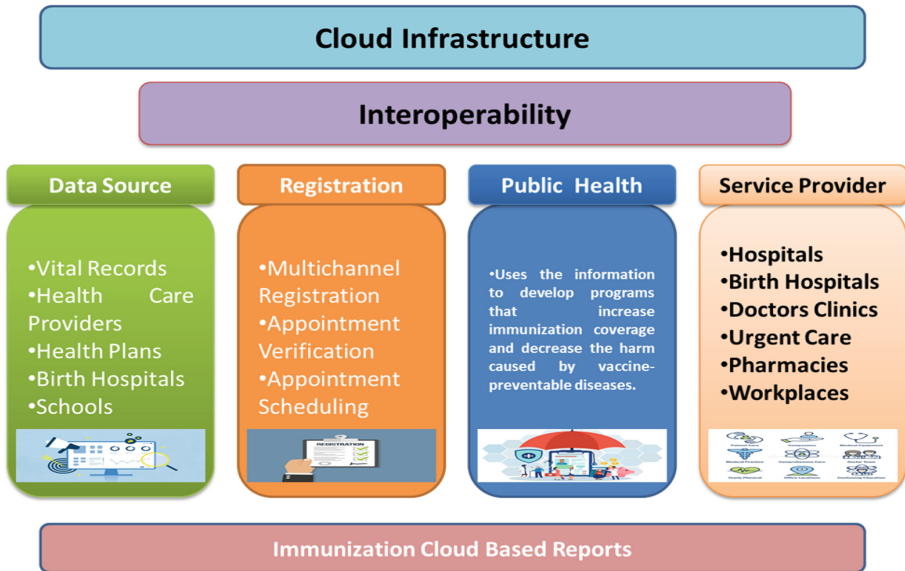


Fig. 1. A Proposed Framework of Cloud Immunization Information System

cloud, an information technology department hosts such virtualized resources and makes them available to users over a network or the internet. Virtual machines (VMs) and parts including servers, memory, network switches, firewalls, load balancers, and storage are examples of these resources.

2.2 Cloud Interoperability

The capacity of the systems to operate successfully and collaborate across various cloud platforms is referred to as cloud interoperability. Cloud interoperability addresses the following issues to help with data quality issues: Precision, promptness, and completeness.

2.3 Data Sources

Vital records, healthcare providers, health plans, birth hospitals, schools, and surveys are some of the places where data on immunizations can be found.

2.4 Registration

Before using the system's various services, citizens must complete CIIS' registration process.

2.5 Public Health

Cloud improves public health by compiling immunization data into a single dependable source. The data can then be utilized to increase immunization rates, direct patient treatment, and ultimately lower the incidence of diseases that can be prevented by vaccination.

2.6 The Service Providers

Among the Service Providers that offer immunization services are hospitals, birthing centers, clinics for doctors, urgent care centers, pharmacies, and workplaces.

The functionality of the suggested framework should be pursued in order to properly support program and stakeholder cloud immunization-related objectives. The goals of the proposed framework can be illustrated as follows:

- Assist medical professionals in providing immunization services that are risk- and age-appropriate.
- Encourage the management and control of disease outbreaks that can be stopped through vaccination.
- Offers cloud vaccination records to those who have completed the necessary authentication.
- Offers predefined and customized evaluation reports that customers may create on their own, independent of IIS employees.
- Supports the national Vaccine Tracking System's data exchange.
- Notifies provider sites of the status of vaccine orders filed in the IIS.
- Creates reports or statistics to enhance the management and responsibility of vaccination inventories [12].

3 Immunization Information System Challenges and Opportunities

The challenges that face IIS include: incomplete data reporting; varying performance levels across IIS; a variety of stakeholder standards, technologies, and regulations; and inconsistent standard implementation.

However, the IIS provide many opportunities such as: Improve IIS Performance, Encourage IIS Standards Adherence, Support the IIS Community, Influence and Monitor the Health IT Environment. Through projects that aim to improve infrastructure and functionality, such as the IIS Minimum Functional Standards and the IIS Annual Report, a self-reported data collection of IIS progress toward achieving the functional standards, the Centers for Disease Control and Prevention has made strides to help IIS move toward a nationwide network since the early 2000s. While these initiatives have helped vaccination programs reach higher functional standards, it is now time to move the emphasis from infrastructure and functionality enhancements to high data quality through critical outcome evaluation and objective measurement of IIS performance. Additionally, in order to achieve the goal of a national repository of high-quality immunization data, it is necessary to address the numerous issues that have an impact on data availability and quality, such as those relating to policy, data sharing, data use, ageing IIS technology, sustainability, and IIS participation [11].

4 Conclusion

This paper discussed the concept of Immunization Information System, and why the countries need to build this system. Its functions, clarify why it is important, propose a framework of cloud Immunization information systems, discuss the levels of this framework and its goals, challenges, and opportunities.

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