PATH

USE OF THE NATIONAL IMMUNIZATION INFORMATION SYSTEM TO IMPROVE VACCINATION COVERAGE

A case study from Vietnam

IDEAL VIETNAM PROJECT

This case study was developed by the Introducing Digital immunization information systems - Exchange And Learning from Vietnam (IDEAL-Vietnam) project, a collaboration of PATH, the Vietnam Ministry of Health, the Vietnam National Expanded Program on Immunization, and Viettel. It was authored by team members from PATH and the National Expanded Program on Immunization.

We hope this report will contribute to ongoing discussions about immunization logistics, and we welcome comments from interested parties.

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ABBREVIATIONS

CHC	Commune Health Center
COVID-19	COVID-19 - coronavirus disease of 2019
EIR	Electronic Immunization Registry
FIF	Fee-based Immunization Facility
IDEAL-Vietnam	Introducing Digital immunization information systems - Exchange And Learning from Vietnam
NEPI	National Expanded Program on Immunization
NIIS	National Immunization Information System

BACKGROUND

GAPS IN IMMUNIZATION COVERAGE

The National Expanded Program on Immunization (NEPI) was introduced in Vietnam in 1981, and in just six years was able to bring the national immunization coverage rate to 87%.[1] Vietnam continued to maintain high levels of immunization, even before the introduction of the country's electronic immunization registry (EIR), the National Immunization Information System (NIIS).[1,2]

However, although the overall rates were very high, there was notable disparity in timely immunization of children from lower-income households, from ethnic minority groups, and those living in rural communities, particularly remote communes located in hard-to-reach mountainous areas.[2] Studies found many reasons these children were more likely than others to experience delays in receiving on-time vaccinations, like region of residence, mothers with lower levels of education, and less household wealth. Within the context of Vietnam in particular, belonging to an ethnic minority group and living in a rural area were two prominent indicators for delayed immunization.[3,4]

Additionally, prior to the introduction of a digital system in Vietnam, paper-based records took more time for already overburdened immunization staff to complete and submit than electronic records; therefore, data often were not finalized in a timely manner. This led to reports that may not have had the most current statistics, or cases in which data were entered incorrectly.

In the paper-based system, each month, staff would have to manually go through files to calculate figures for different reports: vaccine stocks and supply usage; vaccinations of children younger than 1 year and those 18 to 24 months of age; tetanus vaccinations of women; and number of recorded cases of vaccine-preventable diseases. In addition, to prepare for monthly sessions, staff had to manually list the children due for vaccinations, and determine the quantity of specific vaccines needed. This involved searching through the paper registries, copying information, and making manual calculations. Staff then used this information to send individual reminders to caregivers.

Ultimately, paper-based record keeping is often delayed, and can be prone to data errors. Shifting to an electronic system makes entering data more efficient, and leads to a lower overall workload for patient-facing health care staff in particular.

USE OF ELECTRONIC IMMUNIZATION REGISTRIES FOR FULL, TIMELY, AND EQUITABLE IMMUNIZATION

The implementation of EIRs in health care settings around the world has been shown to improve immunization program performance through data accuracy and timeliness, leading to better planning and evaluation from a project management standpoint.[3,5-10] One study, which took place in southern Brazil, found that successful implementation of an EIR increased completion of vaccination schedules across socioeconomic groups, showing overall access equity.[8] However, the effectiveness of EIRs in improving coverage and timeliness of vaccinations has been shown to increase when used in combination with other interventions.[10] A pilot study of an EIR in Vietnam, for example, found that using both an EIR and short message service (text) reminders improved immunization coverage and timeliness of vaccination in the population.[8]

PROJECT OVERVIEW

In 2018, with support from the Bill & Melinda Gates Foundation, the **I**ntroducing **D**igital immunization information systems - **E**xchange **A**nd **L**earning from Vietnam (IDEAL-Vietnam) project was launched by PATH to support Vietnam's transition to a paperless system through the provision of technical support, and to facilitate the exchange and sharing of lessons learned in Vietnam with other countries. Building on the EIR pilot project, the IDEAL-Vietnam project was designed to show what systems and support need to be in place in order to shift Vietnam to a fully digital, national-led platform.

HANOI AND SON LA PROVINCE

Representing a diverse range of geographic and demographic populations, as well as a variety of health care facilities, Vietnam's capital city, Hanoi, and Son La Province were selected for project implementation. Hanoi is an urban setting, with high population density, and offers many private-sector, fee-based facilities in addition to public facilities. Son La Province is in the northwest region of Vietnam. It is a rural border province with a majority ethnic minority population. In 2021, Hanoi and Son La had immunization coverage rates of nearly 96% and 98%, respectively—higher than the country overall (87%).[11]

FULL IMMUNIZATION CRITERIA AND DATA

Defined by NEPI, full immunization is when a child has received all doses of eight childhood vaccines: one dose of bacillus Calmette-Guérin, three doses of hepatitis B, three doses of diphtheria-pertussis-tetanus, three doses of Haemophilus influenzae type B, three doses of polio (at least one of which is inactivated polio vaccine), and one dose of measles (Table 1). The timely full immunization rate is then defined as the number of children who are fully immunized with these basic vaccines before their first birthday, divided by the total number of surviving children who were born within the same period. This indicator, of course, is dependent on the accuracy of the information reported from commune health centers (CHCs) around the country.

Table 1. The National Expanded Program on Immunization on-time vaccination schedule for major vaccines for children in Vietnam.

VACCINE	RECOMMENDED SCHEDULE	ON-TIME
Bacillus Calmette-Guérin	As soon as possible within 30 days of birth	0–30 days after birth
Pentavalent vaccine 1, polio vaccine 1	2 months	56–89 days after birth
Pentavalent vaccine 2, polio vaccine 2	3 months	28–31 days after receiving pentavalent 1
Pentavalent vaccine 3, polio vaccine 3	4 months	28–31 days after receiving pentavalent 2
Full polio vaccine (at least 3 doses of polio vaccine, 1 of which is inactivated polio vaccine)	4 months	119–178 days after birth
Measles 1	9–11 months	270–330 days after birth

DATA SOURCES

Before the NIIS was launched, all data received from the CHCs to inform reports sent to the district, provincial, and national levels came from paper-based logbooks. This included all data regarding immunization coverage. There were several flaws with the logbooks, including mistakes in spelling or other patient details, leading to inaccurate reporting data; (2) manual calculations of the number of children vaccinated used to determine on-time vaccination rates; and (3) duplication of records for patients who had moved or visited a different clinic. Moving to the NIIS mitigated these issues by decreasing health care worker burden and improving data quality.

Photo - Immunization staff viewing updated vaccination data on mobile application for immunization.

PATH and NEPI partnered with the World Health Organization from 2010 through 2012 under Project Optimize to identify ways to improve vaccine supply chains. Optimize implemented the first version of the NIIS as it is today. An evaluation of the project showed that in some locations, the accuracy of stored vaccine information went from 77% to 100%.[12] The same project found the time required to generate reports dropped at different health care levels. At the district level, the average time spent on monthly child immunization reports went form 39 minutes to 23 minutes. At the district level, the length of time to generate this report went from 22 minutes to 5 minutes.

As mentioned, the full immunization rate is determined by dividing the number of children who meet the definition of being fully immunized by the total number of surviving children who were born within the same period. Prior to NIIS implementation, the denominator utilized for this equation was not the actual number of registered births, but rather an estimation based on the national birth rate, a number that was sometimes adjusted throughout the year. Now, with the NIIS, it is easy to calculate the total number of registered live children born in the previous year. Use of the NIIS, coupled with the rigorous system of cross-checking between different programs in Vietnam (population and family planning; management of pregnant women; maternal, newborn, and child health) has helped to mitigate the number of zero-dose children. This means that the overall rate is a much more accurate representation of fully immunized children in Vietnam.

Photo - Immunization staff is participating in a meeting to implement activities in the project

IMPROVING VACCINATION PROGRAMS TO PROVIDE TIMELY, EQUITABLE, AND FULL COVERAGE OF CHILDHOOD VACCINES

Ensuring children have equitable, timely access to the childhood vaccines required to be fully immunized is the goal of any immunization program. The IDEAL-Vietnam project, through implementation of the NIIS, attempted to address the issues Vietnam continues to face in ensuring full immunization of all children through three elements: data quality and use, private-sector engagement, and continuation of care through e-immunization cards.

DATA QUALITY AND USE

Data quality is particularly important for planning and monitoring. When health care workers at any level use inaccurate data, the effects can include vaccine wastage and shortages, and children not being vaccinated on time. Accurate, timely data allow health care workers to identify defaulters from the immunization programs, enabling them to follow up and reduce overall dropout rates.[9] These data also allow health care workers to track patterns in defaulters, to see if they share demographic characteristics, so they can plan more targeted outreach to raise awareness about the benefits of vaccines.[9]

Photo: Training of trainers session for health care staff at provincial level on data quality and data use

Production of high-quality data and data use are intrinsically linked. When people use high-quality data, their faith in those data increases, reinforcing their data use. This not only increases the likelihood that they will use data again in the future, but also generates demand for higher-quality data.[6,13] As a cross-cutting component, the IDEAL-Vietnam project integrated data quality and use into many activities, including:

- Detailed standard operating procedures and guidelines to help health care workers with everyday use of the NIIS.
- Implementation of a series of training of trainers sessions for health care staff at provincial and district levels, who could then mentor CHC colleagues.
- Layers of formal and informal support, including in-person and online supportive supervision and Zalo groups for NIIS users.

The implementation of these interventions resulted in generation of better-quality data and data use in planning for vaccination campaigns and estimating vaccine stocks. For example, in CHCs in Son La, accuracy of vaccine stock data increased from 80% to 100%.

**More information on data quality and use under the IDEAL-Vietnam project can be found in Improving data quality and use in an electronic immunization registry: A case study from Vietnam.*

PRIVATE-SECTOR ENGAGEMENT

To ensure data in the NIIS are complete, all types of facilities must input immunization information and client data. This includes both private-sector and fee-based immunization facilities (FIFs). NIIS uptake has been slow in FIFs, especially in facilities with a high volume of clients, because many FIFs already have their own internal digital systems for tracking client records. Integrating their internal system with the NIIS can be expensive, as it requires either the development of an application programming interface to transfer data or additional hours of manual data entry. Vietnam instituted regulations mandating FIFs to utilize the NIIS; however, these regulations have not been enforced. To sensitize FIFs on the importance of using the NIIS to improve data quality and use, the IDEAL-Vietnam project held two training sessions for FIF staff, after which NIIS use in these facilities increased.

**More information on private-sector engagement under the IDEAL-Vietnam project can be found in Engaging private-sector providers in immunization data management and use: Perspectives from Vietnam.*

USE OF E-IMMUNIZATION CARDS

In an effort to further improve data quality and use, while adapting to the increasing mobility and connectivity of the population of Vietnam as a whole, the IDEAL-Vietnam project, in partnership with Viettel, technical partner for NIIS development, launched an electronic immunization card (Sổ Tiêm Chủng Điện Tử), a mobile phone application for caregivers and patients to access their own and their children's immunization records. Linked with the NIIS records inputted by health care workers, the Sổ Tiêm Chủng Điện Tử empowers caregivers and patients to take charge of their vaccinations by giving them access to their own files, which will ultimately improve data quality through validation.

**More information on e-immunization cards can be found in E-immunization card: Empowering parents and caregivers to take charge of their children's immunization.*

ENDLINE RESULTS

To measure the impact of the IDEAL-Vietnam project, data were collected at baseline and endline in a pre/post-study design. Data collectors used NIIS data to measure changes in immunization outcomes in the two project sites, Hanoi and Son La Province, and were primarily looking at on-time vaccination rates, dropout rates, and full vaccination coverage. The study cohort included 81,301 children of a diverse range of ethnicities, and representing both urban and rural settings, although noticeably more rural, and encompassed data from CHCs and FIFs.

It is important to note that data collection on immunization coverage took place during 2020 and 2021, when Vietnam was under very strict social distancing measures in response to the COVID-19 pandemic. These restrictions were particularly rigorous in Hanoi. As reported by NEPI, full immunization coverage in Vietnam decreased from nearly 97% in 2020 to 87% in 2021.[11]

On-time vaccination coverage, which is determined by the recommended age for vaccine delivery, was shown to improve through use of the NIIS. The study showed a statistically significant increase in timeliness of vaccine administration in Hanoi and Son La, across vaccinations. Notably, in Hanoi, on-time full polio coverage went from 59% to nearly 76%. In Son La, on-time vaccination with the first dose of pentavalent vaccine increased from 31% to 52% post intervention.

Son La also saw a reduction in the dropout rate as the result of the intervention. The dropout rate from the first to the third dose of pentavalent vaccine dropped from just more than 9% to approximately 2%, and the dropout rate for bacillus Calmette-Guérin–measles 1 vaccine decreased from 6% to 4%. In contrast, the dropout rates for these vaccines in Hanoi increased.

Son La Province saw a significant increase in full immunization coverage (i.e., coverage of all vaccines): from 77% to nearly 93%. Hanoi's full immunization coverage, however, decreased as the result of the impact of COVID-19.

LESSONS LEARNED

Improve data quality and use. High-quality data provide valuable information for use in effective project management through monitoring and evaluation, which leads to better planning. For the NIIS, this has meant more timely and accurate reporting; identification of gaps in resources; tracking of vaccination dropout rates; evaluations of health facility performance and addressing challenges through supportive supervision; and the ability to identify specific vaccination needs in different areas. Identifying and closing gaps in the immunization program through better data quality and use means making the program better overall, making vaccination access more equitable overall.

Secure strong commitment from leaders at all levels. In order to be sustainable, EIR implementation should be a government-owned process with engagement and partnership at all stages. This includes, but is not limited to, clear, enforced regulations regarding the responsibility of immunization facilities to use the NIIS, with clear penalties for violating these; dedication of financial and human resources; and commitment to owning the platform as it expands to include the whole nation.

Invest in sufficient resources. From the outset, human, equipment, and financial resources need to be outlined, costed, and budgeted. Costing should be revisited at each stage of implementation, but is especially important for the transition to a paperless system. As the system grows and takes on more clients and files, the resources needed will grow with it. Mapping these investments from the beginning will ensure it is a sustainable, realistic project to improve immunization coverage for all.

Focus on changing awareness, attitudes, practices, and efforts of health care workers. The NIIS is only a tool; health care workers play the important roles in improving data quality and utilizing data from the system. Overall support needs to focus on data-driven decision-making at all levels. In particular, this means building the capacity of health care workers and immunization managers to use high-quality data in all planning processes. This will be made possible by enhancing data quality and use, and building an overall culture of quality data, with all staff. For example, utilizing trainings of trainers to build a network of technical support during implementation will strengthen the framework for high-quality data through capacity-building of immunization managers and health care workers. It is an ongoing process that needs to be flexible and adaptable to the context.

Engage the private sector. Creating buy-in among FIFs is key to the success of any EIR. If there is no incentive for them to input data into the national system, the database will always be incomplete. This means it will not be effective in terms of measuring immunization coverage and providing general data for planning and management purposes. Ideally, private-sector engagement will be regulated by the government, which will ensure they follow through with inputting the data in a sustainable manner.

Empower caregivers through data. With the increase of mobile network coverage, and the accessibility of mobile data and the internet, empowering patients to take their own and their loved ones' health into their own hands is the most sustainable method to ensure immunization coverage. Engaging caregivers in their children's health care through e-immunization cards or short message service reminders ultimately leads to higher-quality data, increased timeliness of vaccination, and lower dropout rates.

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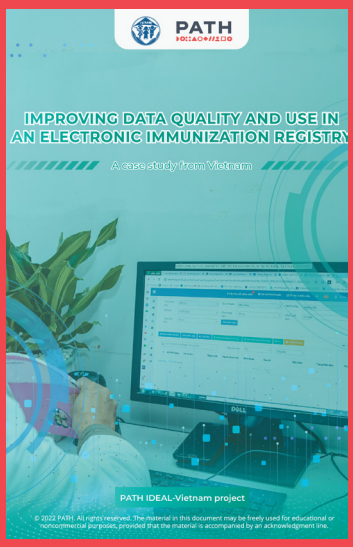
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