



PATH
10::▲○◆//2□6

IMPROVING DATA QUALITY AND USE IN AN ELECTRONIC IMMUNIZATION REGISTRY

A case study from Vietnam



PATH IDEAL-Vietnam project

© 2022 PATH. All rights reserved. The material in this document may be freely used for educational or noncommercial purposes, provided that the material is accompanied by an acknowledgment line.

TABLE OF CONTENTS

ABBREVIATIONS	3
PURPOSE	5
BACKGROUND	5
WHY IS DATA QUALITY IMPORTANT?	6
DEFINING DATA QUALITY	8
DATA QUALITY ISSUES IN THE NIIS	9
ENSURING DATA QUALITY AND DATA USE	10
RESULTS.....	13
LESSONS LEARNED & RECOMMENDATIONS	15
REFERENCE.....	16
READ MORE.....	17

ABBREVIATIONS

API	Application Programming Interface
CDC	Provincial Center for Disease Control
CHC	Commune Health Center
EIR	Electronic Immunization Registry
EPI	Expanded Program on Immunization
IT	Information Technology
FIF	Fee-based Immunization Facility
MOH	Ministry of Health
NEPI	National Expanded Program on Immunization
NIIS	National Immunization Information System
SOP	Standard Operating Procedure
SS	Supportive Supervision
STCDT	Sổ Tiêm Chứng Điện Tử (e-immunization card mobile application)
ToT	Training of Trainers
WHO	World Health Organization



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

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

This work was funded by a grant from the Bill & Melinda Gates Foundation. The views expressed herein are solely those of the authors and do not necessarily reflect the views of the foundation.

© 2022 PATH. All rights reserved. The material in this document may be freely used for educational or noncommercial purposes, provided that the material is accompanied by an acknowledgment line.

Suggested Citation: Introducing Digital immunization information systems—Exchange And Learning from Vietnam (IDEAL-Vietnam). Improving Data Quality and Use in an Electronic Immunization Registry: A Case Study From Vietnam. Hanoi, Vietnam: PATH; 2022.

Photo credit: PATH

PURPOSE

Building an electronic immunization registry (EIR) in Vietnam required years of hard work, patience, and perseverance from people at all levels of health care systems across the country. In the years since its inception, emphasis has been placed on the quality of data entered into the system and the subsequent use of that data at all levels to inform evidence-based decisions.

This case study outlines the aspects of strengthening data quality and use in the National Immunization Information System (NIIS) through the Introducing Digital Immunization information systems–Exchange And Learning from Vietnam (IDEAL) project. It details how, with the strong collaboration of key partners, Vietnam has implemented these activities within the system of operation today. We hope that this case can be studied, learned from, and ultimately improved upon by public health practitioners and governments with similar socioeconomic contexts that want to create their own EIR with high-quality data and achieve the benefits from the use of such data.



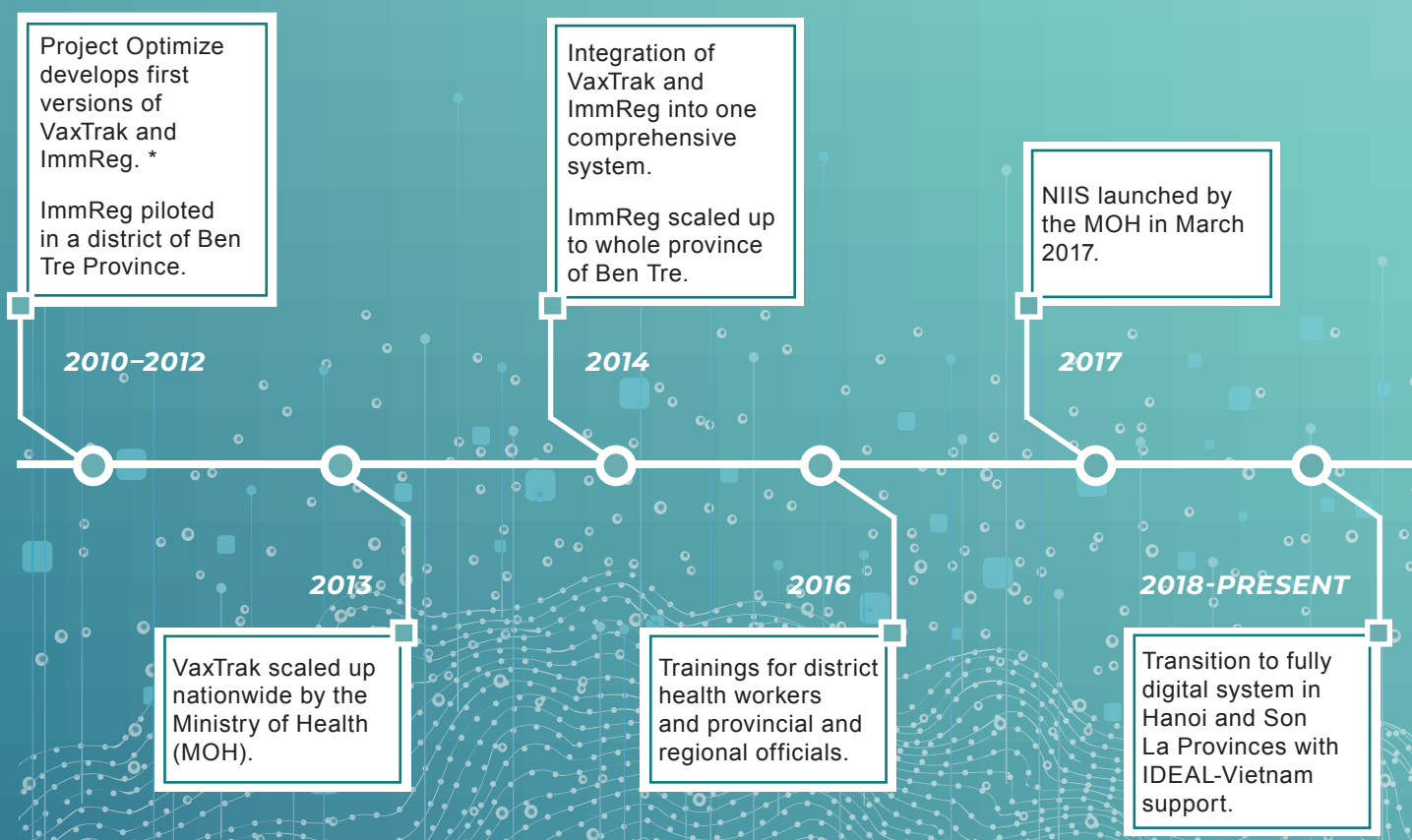
BACKGROUND

From 2010 to 2012, PATH, Vietnam's National Extended Program on Immunization (NEPI), and the World Health Organization (WHO) partnered for Project Optimize, which focused on identifying ways in which vaccine supply chains can be made stronger, more adaptable, and more efficient to extend the reach of lifesaving immunizations. After years of development and piloting, the government of Vietnam launched the National Immunization Information System (NIIS) in 2017. The following year, with support from the Bill & Melinda Gates Foundation, the IDEAL project was launched by PATH to continue supporting the 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. However, since the introduction and implementation of the NIIS nationwide, health care workers across the

country have had the burden of using a parallel EIR alongside the paper-based system to record data and aggregated reports, creating a heavier workload.

The IDEAL project was designed to show what systems and supports need to be in place to shift to a fully digital national platform. Hanoi and Son La were selected as project sites, representing a diverse range of health care facilities, rural and urban, with varying access to the internet and computers. PATH and NEPI carried out a series of activities to support the selected provinces' move to a completely paperless system for immunization reports in Vietnam, improving the data quality within the NIIS system as well as cultivating a culture of data use for health care workers at all levels, across facilities.

TIMELINE OF THE NIIS DEVELOPMENT AND DEPLOYMENT IN VIETNAM



*VaxTrak is a digital vaccine management system, and ImmReg is a digital immunization registration system.

WHY IS DATA QUALITY IMPORTANT?

The understanding and use of high-quality data is critical to the success of an EIR. Within programs in general, the use of quality data can enable effective program management through facilitating more careful monitoring and evaluation of program value, which can then lead to better planning processes. For immunization programs in general, and the NIIS in particular, better data and its use have a multitude of benefits, ultimately leading to better health outcomes for the community at large. These include, but are not limited to:

- Identification of gaps in resources that allow for better monthly and annual planning, meaning improved coverage and vaccine availability due to better supply allocation.^{5,6}
- The ability to identify specific vaccination needs in different areas.⁵
- Reduction of vaccine wastage through more accurate tracking.^{5,6}
- Tracking vaccination dropout rate.
- Evaluating the performance of health facilities and identifying priority areas to be addressed through supportive supervision.
- Applying NIIS data for other programs like the Vitamin A campaign.
- Ease of planning routine immunization campaigns, as well as monitoring the emergence of potential public health trends and concerns, as with outbreaks like COVID-19.^{4,5}

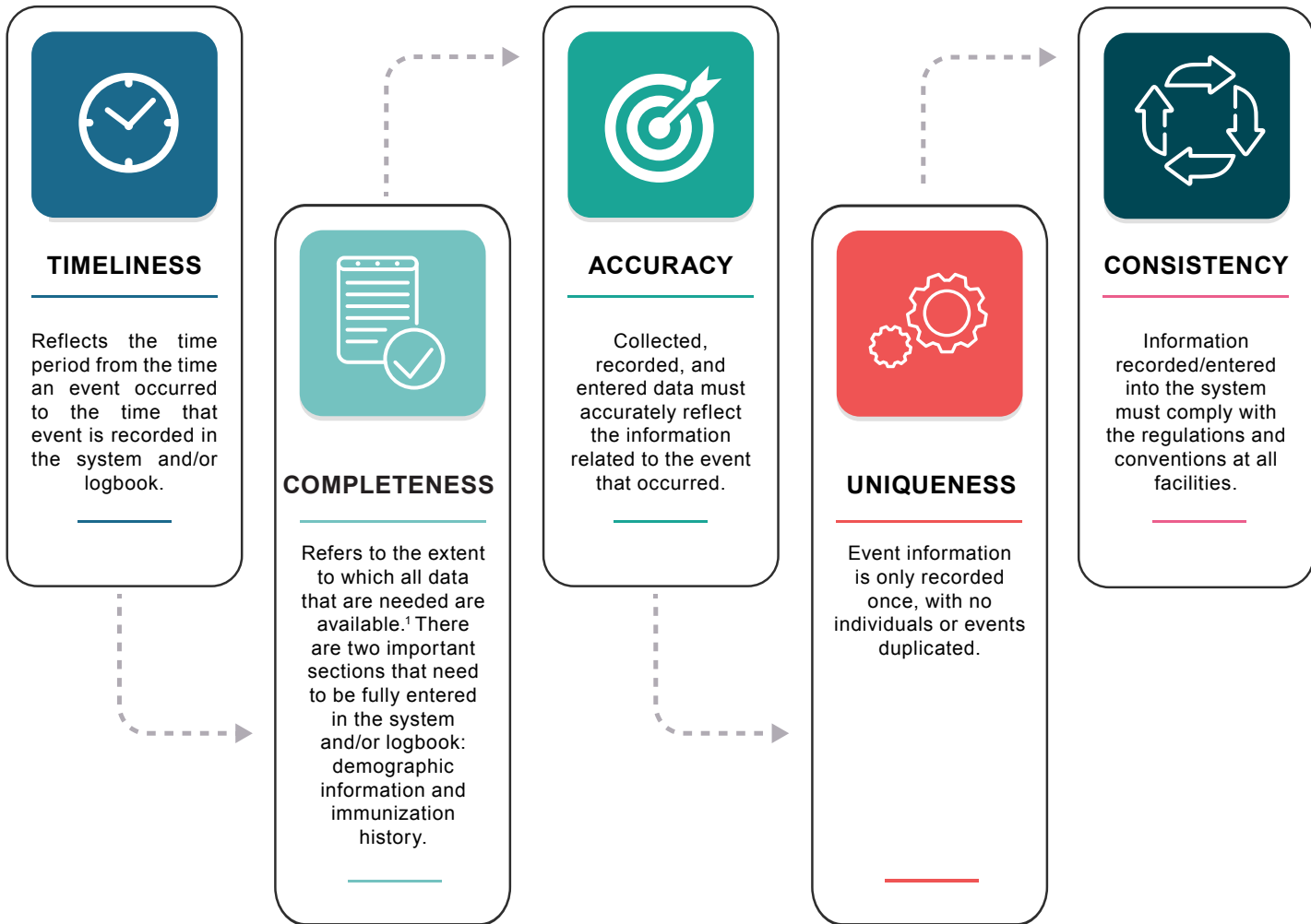
The benefits that come with data usage, however, are dependent on high-quality data. It is important to remember that data quality and data use are intrinsically linked, with the success of one being dependent on the other. When people use high-quality data, and see the value it brings, their faith in that data increases, reinforcing their data use. This not only increases the likelihood that they will use data again in the future, but it also generates demand for higher-quality data.^{6,7} And so the cycle of data use and data quality continues.

With the NIIS, data quality is particularly important for planning and monitoring. Should health care workers, at any level, use inaccurate data, the effects can include vaccination wastage, vaccination shortages, and children not being immunized on time.³ PATH recognizes the invaluable benefits of using quality data and has worked with NEPI to focus on its improvement within the NIIS through IDEAL project interventions.



DEFINING DATA QUALITY

Data quality is multidimensional in nature, and it can be measured by many different indicators.^{1,2,3} To measure the impact of IDEAL over time, PATH selected five factors that are frequently used to define the quality of data: timeliness, completeness, accuracy, uniqueness, and consistency.³ **These are defined as:**



DATA QUALITY ISSUES IN THE NIIS

Before the IDEAL project, general challenges that contributed to data quality issues included low uptake of the new digital system in facilities, and at fee-based immunization facilities in particular; delays with data entry; duplications of records; and lack of knowledge and skill on data quality and data use in general. These issues with quality meant the data in the system did not accurately represent the reality, and so health care workers had little faith in the data the system produced. In fact, the NIIS was seen by some as burdensome—an extra task that did not help alleviate their work as intended.



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



FEE-BASED IMMUNIZATION FACILITIES

For Vietnam to benefit fully from its EIR, the immunization data of all children need to be entered into the NIIS, including fee-based immunization facilities (FIFs). In Vietnam currently, free EPI immunizations are provided at around 12,000 commune health centers (CHCs), while non-EPI immunization is provided at about 2,000 FIFs.⁸

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 clients' records. Thus, FIFs have two options: (1) entering data into both their own software and the NIIS, or

(2) entering data into their own systems and using an application programming interface (API) to transfer data to the NIIS. Using an API is the easier of the two options, allowing instant transfer and sharing of records with the NIIS. However, while the second option is easier, many FIFs do not have the budget to hire a programmer to create an API for their facilities. Most of the FIFs that do use an API to exchange data are big facilities with information technology (IT) teams to support not only the development but also the deployment of an API. Many FIFs have to manually input data into both systems, doubling workloads, and so they can struggle to ensure high-quality data.



DUPLICATIVE DATA

Avoiding duplication is integral to maintaining data quality and encouraging data use. Using the wrong information can lead to vaccination wastage, vaccination shortages, and children not being immunized on time.³ To avoid this, health care workers have to spend time “cleaning” the data entered in the system. This process of verifying potential duplications is a weekly task accomplished by reviewing files

in the system with the same name and date of birth. The health care worker decides if the two are the same person, usually by calling the patient to verify. This process is time intensive and increases workload but, in the end, having a complete picture of child immunization is necessary to ensure monthly planning for vaccination days will avoid wastage or shortage and ensure on-time vaccination for all children.

ENSURING DATA QUALITY AND DATA USE

The IDEAL project allowed PATH and NEPI to respond to emerging issues in data quality and use in the NIIS. At the project sites of Hanoi and Son La, IDEAL interventions were used to address those issues, which were then measured to determine the impact of the interventions provided.



TRAINING OF TRAINERS AND E-LEARNING

As a technical expert that had been involved since the outset of the project, PATH provided training support, including methodology and materials, for data quality and use within the NIIS at all levels via the IDEAL project. PATH used a training of trainers (TOT) approach wherein health care workers from the district level were trained, and then became “mentors” by learning how to train health care workers at the commune level in the system as well.

Mentors became focal points, providing direct technical support to their peers on data quality and use. This approach was used to enable

end user buy-in and ownership, and overall sustainability of the training as a whole. Content for the TOTs focused on duplication elimination and merging, or verification, standardizing data input, and report generation. Trainings started in 2019, shifted to online sessions during the peak of the COVID-19 pandemic, and then returned to in-person in 2022. These took place in Hanoi and Son La, with the two project locations having distinct challenges. Hanoi has many FIFs, and the needs of those facilities are much different than those of CHCs. Son La, on the other hand, has little exposure to computers and limited internet connection.



“I participated in the training course on data quality and data use last year. After the training, my knowledge and skills in data quality and data use are better, so I usually check the data for completeness and accuracy before enter[ing] them into the system.”

–Commune health center staff

PATH, in collaboration with NEPI, also built an online learning platform, called e-Learning, to host courses for immunization staff on the use of the NIIS. There is a regular need for refresher trainings for current staff because of frequent updates to the NIIS to reflect standard modifications in the program, as well as user feedback. In addition, trainings for new staff are in high demand due to high turnover rates at the facility level. The platform also includes functions for managers to monitor, track, and manage staff’s learning process.

The e-Learning platform has been particularly successful because of increased internet connectivity rates along with the widespread use of smartphones and computers in the general population. e-Learning provides unlimited availability of the training modules and is compatible with smartphones, enabling users to learn at their own pace, from whatever location and device is most convenient for them. Online trainings are of particular value to populations who experience time and geographical distance constraints, which might limit their access to in-person trainings.

In the context of COVID-19, the e-Learning platform became critical in maintaining an ongoing learning environment while staff practiced social distancing and in updating staff as the situation was evolving rapidly. Importantly, the platform was quickly modified during the COVID-19 immunization campaign to keep immunization staff up to date on ever-changing information, policies, and guidelines. e-Learning offers the latest trainings for staff at all levels, including facility staff at over 11,000 commune health centers across Vietnam.



FORMAL SUPPORT—GUIDELINES, SUPPORTIVE SUPERVISION, AND ADVOCACY

Support for trained mentors did not stop when the TOT sessions were completed. Technical support is particularly important for sustainability because if end users are unable to use the system, data will not be entered or used. Follow-up formal support came in three methods: (1) standard operating procedures (SOPs) and guidelines, (2) supportive supervision (SS), and (3) advocacy.

PATH and NEPI developed comprehensive, user-friendly guidelines and SOPs to assist end users on the ground to focus on data quality and use of the NIIS in their facilities. Feedback from the end-users has led to the SOPs being updated three times, most recently in 2019, ensuring they are as practical and manageable as possible. The manual, *Strengthen Data Quality and Data Use in the Management of the National Extended Program on Immunization*, was launched by PATH and NEPI in 2020 and provides detailed explanations of what good-quality data consists of, how to ensure data is high quality, and how to use quality data.

In-person SS is another method of formal support employed to ensure successful



Photo- Son La provincial EPI manager conducts virtual supportive supervision via Google Meets application.

implementation of data quality and use in facilities in Hanoi and Son La. The PATH IDEAL team joined the provincial Center for Disease Control (CDC) to make site visits to facilities in the two project provinces to see how the system was operating and what could be done, if anything, to improve the experience. During the COVID-19 pandemic, these visits were adjusted to virtual sessions, which had both positive and negative outcomes. On the one hand, moving supervision to an online portal was a low-cost, convenient alternative to in-person visits. For hard-to-reach destinations in Son La, the introduction of virtual SS meant that staff were able to have more supervision meetings than before. Staff on the ground reported that virtual SS is suited best for system updates, as there are many logistical processes that cannot be reviewed properly



“The supportive supervision helps health care workers at the lower levels can do correctly [can operate the system correctly] as required by providing the guidance, on-the-job training on data quality, and data use skills.”

—Commune health center staff

Formal support would not be complete without higher-level advocacy. Particularly within the Vietnamese context, mandates from the government are vital for implementation-level

buy-in and commitment. PATH and NEPI advocated for provincial-level CDCs to issue letters to CHCs, instructing them on data quality and use in the NIIS.



INFORMAL SUPPORT—ZALO GROUPS

In Vietnam today, nearly all internet users report owning a cell phone, and 75 percent of these users cite their cell phone as their preferred method of connection. Part of that development has been the introduction of social media groups. In Vietnam, Zalo, a chat messaging application, is incredibly popular and has proven to be a useful platform for informal support for health care workers focusing on data quality and use within the NIIS. Trained mentors use Zalo groups to discuss technical issues they are encountering, offering peer support and practical solutions before needing to turn to another outlet for help.



E-IMMUNIZATION CARD ROLLOUT

In an effort to further improve data quality and use, PATH and NEPI partnered with Viettel to launch an electronic immunization (e-immunization) card (Sổ Tiêm Chứng Điện Tử, or STCDT), a mobile phone application for caregivers and patients to access their own or their children's immunization records. The rollout of STCDT is part of moving away from the traditional paper-based system, and it will eventually replace the paper records, which could be lost or prone to errors. Linked with the NIIS records entered by health care workers, STCDT allows caregivers and patients access to their own files, improving data quality through validation, and empowers them to take charge of their family members' immunization.



RESULTS

PATH hypothesized that the interventions implemented through the IDEAL project would maintain or improve data quality, data use, vaccination timeliness, dropout rates, and vaccination coverage in the intervention areas. Baseline and endline surveys were collected in 2018 and 2021, respectively, at a range of health care facilities: commune health centers, hospitals, and fee-based immunization facilities.

■ QUANTITATIVE



TIMELINESS

Across facilities, the study found significant changes in timeliness of data. In CHCs in Hanoi and Son La, the percentage of clients registered in the NIIS within three days of birth increased from 67.7 to 88.2 percent. In these same facilities, clients' vaccination information entered in the NIIS within three days of vaccination was particularly significant in Son La, increasing from 46.7 percent in 2018 to 78 percent in 2021. FIFs and hospitals also saw increases in this indicator. FIFs saw the percent of clients' immunization information entered in the NIIS within three days of vaccination increase from 90.2 to 95.2 percent. Hospitals reported an increase from 88.7 to 96.9 percent.



COMPLETENESS

The surveys showed that completeness of data quality had some improvement as well, particularly in clients' immunization information being fully entered in the NIIS. CHCs saw an increase from 96 to 99 percent, FIFs saw an increased from 90.8 percent to 98.5 percent, and hospitals still very high at 100%, all statistically significant outcomes. CHCs also had an impressive increase in clients' personal information being fully entered in the NIIS, from 89.4 to 99.4 percent. Similarly, for FIFs, this indicator increased slow from 97.4 percent to 98.9 percent, seeming to indicate this portion is becoming less complete in those facilities. In hospitals, an important result was the increase of all vaccines and their stock information entered into the NIIS from 57.1 to 100 percent.



ACCURACY

At the endline assessment, demographic information and immunization information was compared between the paper-based logbook and the digital NIIS. It found an increase in consistency of immunization information at CHCs from 87.5 to 96.3 percent. In FIFs, 98.9 percent of the demographic information between the paper records and the NIIS matched, but there was no baseline data recorded to measure the change. Looking at outcomes for hospitals, the study found that immunization information of clients, doses, and date of injection matched 100 percent at the endline, compared with 92 percent at baseline.

■ QUALITATIVE

In addition to a quantitative survey, data collectors arranged a series of in-depth interviews with participants representing health care workers at all levels, with a variety of experience, in both project provinces. Interviewees discussed how they felt the IDEAL project had impacted their work in terms of data quality knowledge, data use, and changes in immunization coverage over two years. ***The interviews showed that respondents were able to explain the three main criteria of data quality of timeliness, completeness, and accuracy. Some even gave detail on other aspects like uniqueness and consistency.***

All facilities mentioned human resources as the most important factor associated with data quality. For example, some respondents noted that the capacity and skills of staff members managing the NIIS may still not be high enough, on top of them being stretched by demanding workloads. Others mentioned a lack of equipment like computers, barcode readers, and printers as a barrier to data quality.



“Some facilities do not have enough computers for [the] immunization program separately; they need to share it with other programs at the facility. So they sometimes want to analyze the immunization data but they cannot because there is no computer at that time.”

–District health center staff

When discussing data use, respondents gave a full picture of how they use the data to inform activities on a day-to-day basis. At the facility level, CHCs use the data to make detailed immunization plans, including the number of patients, immunization days, health care staff needed, and vaccinations required, among others. Also, the data can be used to track dropout rates, evaluate general immunization progress, inform other programs like the

Vitamin A campaign, and validate the quality of the data in the system. All respondents shared that their facility uses data from the NIIS, most frequently to make immunization reports for higher-level managers who, in turn, use the data to evaluate the performance of health facilities.

In order to improve data quality, respondents agreed that **refresher trainings on data quality and use, improvements to the digital system itself to help measure quality of data, the promotion of the e-immunization card for caregivers, and on-time supportive supervision** would all be key aspects going forward. Currently, there is a lack of capacity in analyzing and using the data at the health care worker level, indicating that health care workers' skillsets and confidence need to be improved.

LESSONS LEARNED & RECOMMENDATIONS

As is clear from this case study, Vietnam has invested significant time and energy into ensuring quality data is entered into the NIIS and used by health care workers at all levels of decision-making. Along the way, there have been many successes, along with some lessons learned and recommendations:

- Make sure to invest in building capacity for end users. They should be motivated and encouraged because they are an integral factor for success.



Prior to training, this includes evaluating end user needs before designing a training program by confirming their level of comfort with and general exposure to IT.



During training, this means:

- 1** Showing health care workers common mistakes that are made in the system, and how to avoid them.
- 2** Increasing the awareness of staff at all levels on the importance of data quality and the impact of poor-quality data for planning and decision-making.
- 3** Teaching staff at all levels how to use data from the NIIS for both short-term and long-term use and planning purposes.



Post-training, this includes continued support like developing and introducing SOPs to ensure data is entered at a high level and providing supportive supervision for end users to monitor their implementation and compliance with SOPs.

- Putting in place a system for quality control of data entered into the EIR system, particularly at the outset of implementation. For example, conducting data review meetings and/or creating national guidelines and protocols on data use would help the initial data quality and long-term sustainability of an EIR.
- Clear, government-enforced regulations on the responsibility of immunization facilities to use the NIIS, with clear penalties for violating these.
- Integrating data from FIF internal systems with the NIIS using APIs is more time efficient, but it requires time and money, which should be clearly allocated and enforced by the government. Without an API, FIF staff have to enter data into both their own EIR and the NIIS, doubling their work. Without clear mandates from the government on using the NIIS, some FIFs, particularly those with a high volume of clients, are not motivated to take on this double work.
- Strengthen the implementation of e-immunization cards, which can be monitored by parents and will help to improve the quality of data entered into the system.
- The introduction of an EIR in Vietnam has made reporting easier at all levels, as well as improved the functionality of health centers in general.

REFERENCE

- 1 Bergdahl M, Ehling M, Elvers E, Földesi E, et al. *Handbook on Data Quality Assessment Methods and Tools*. Weisbaden: European Commission Eurostat; 2007.
<https://millenniumindicators.un.org/unsd/dnss/docs-nqaf/Eurostat-HANDBOOK%20ON%20DATA%20QUALITY%20ASSESSMENT%20METHODS%20AND%20TOOLS%20%20I.pdf>.
- 2 Cai L, Zhu Y. *The challenges of data quality and data quality assessment in the big data era*. *Data Science Journal*. 2015;14(2):1–10.
<http://doi.org/10.5334/dsj-2015-002>.
- 3 Chen H, Hailey D, Wang N, Yu P. A review of data quality assessment methods for public health information systems. *International Journal of Environmental Research and Public Health*. 2014;11(5):5170–5207.
<https://doi.org/10.3390%2Fijerph110505170>.
- 4 World Health Organization (WHO) Dept. of Immunization, Vaccines and Biologicals. *Global Routine Immunization Strategies and Practices (GRISP)*. Geneva: WHO; 2016.
https://apps.who.int/iris/bitstream/handle/10665/204500/9789241510103_eng.pdf?sequence=1&isAllowed=y.
- 5 European Centre for Disease Prevention and Control (ECDC). *Designing and Implementing an Immunisation Information System*. Stockholm: ECDC; 2018.
https://www.ecdc.europa.eu/sites/default/files/documents/designing-implementing-immunisation-information-system_0.pdf.
- 6 Immunization Data: Evidence for Action. *A Realist Review of What Works to Improve Data Use for Immunization, Evidence from Low- and Middle-Income Countries*. Seattle: PATH; Washington, DC: Pan American Health Organization; 2019.
https://iris.paho.org/bitstream/handle/10665.2/50482/9789275120613_spa.pdf.
- 7 Nutley T. *Improving Data Use in Decision Making: An Intervention to Strengthen Health Systems*. Chapel Hill: MEASURE Evaluation; Washington, DC: USAID; 2012.
https://www.measureevaluation.org/resources/publications/sr-12-73/at_download/document.
- 8 Vietnam Ministry of Health (MOH). *Circular 38/2017/TT-BYT*. Hanoi: Vietnam MOH; October 17, 2017.
<https://thuvienphapluat.vn/van-ban/The-thao-Y-te/Thong-tu-38-2017-TT-BYT-danh-muc-benh-truyen-nhiem-phai-su-dung-vac-xin-sinh-pham-y-te-bat-buoc-364984.aspx>.

READ MORE

