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Electronic Immunization Registry in Workload Reduction and Efficiency Enhancement for Immunization Program in Vietnam



TABLE OF CONTENT

04. **IMMUNIZATION PROGRAM WORKLOADS
WITHIN VIETNAM CONTEXT**
06. **CHANGE OF WORKLOAD FOR IMMUNIZATION
STAFF AT FACILITIES—DIRECT POINT OF CARE**
10. **CHANGE OF WORKLOAD FOR IMMUNIZATION
STAFF AT THE MANAGEMENT LEVEL AT THE
DISTRICT, PROVINCIAL, REGIONAL, AND
NATIONAL LEVELS OF THE NEPI**
12. **CONCLUSIONS AND RECOMMENDATIONS**

ABBREVIATIONS

ABBREVIATIONS	CONTENT
CDC	Center for Disease Control and Prevention
CHC	Commune Health Center
EIR	Electronic Immunization Registry
FIF	Fee-based Immunization Facility
IDEAL Vietnam	Introducing Digital immunization information systems - Exchange and Learning from Vietnam
MOH	Ministry of Health
NEPI	National Expanded Program on Immunization
NIIS	National Immunization Information System

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, the Vietnam National Expanded Program on Immunization, and Viettel, and 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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▶ 1. Immunization program workloads within Vietnam context



Information and information sharing are crucial to the delivery of care at all levels of the health care delivery system—the patient, the care team, the health care organization, and the encompassing political-economic environment.¹ Immunization services and programs are no exception.

To effectively and safely provide immunization services, the health workers who are in charge of immunization (immunization staff) must have ready access to at least three major types of client information: demographics, immunization records, and history of adverse event following immunization.² In addition, they need information on client preferences and values (such as religion, tribal customs, etc.) and important administration information, such as status and availability of supporting resources (parents, legal guardians, financial information, etc.).

For upper levels of district, provincial, and National Expanded Program on Immunization (NEPI), government funding and regulatory agencies, and research institutions, having complete population immunization data can provide the essential information needed to execute regulatory oversight, protect and advance the public health through surveillance/monitoring, accelerate research, and disseminate new knowledge/evidence for immunization campaigns and outbreak response.³ Therefore, maintaining a timely and accurate immunization database, while it may seem a mundane administrative task, is an essential component to complementing the clinical aspect of immunization staff's work.

In the effort to reduce the burden of this administrative aspect for immunization staff, many countries have implemented the electronic immunization registry (EIR) system. However, there is not always a parallel relationship between advanced technology and workloads of those who directly perform the work, so it is important to understand how deployment of an EIR impacts the workloads of health care workers.

In the context of Vietnam's immunization services in the pre-EIR era, the immunization and vaccine management systems were very information- and labor-intensive and relied on a communal political structure and on the dedication of staff to maintain and operate this immunization and vaccine accurately and timely.

In Vietnam, immunization staff are responsible for both administrative planning and reporting, in addition to actual vaccination and follow-up for children. Errors were easy to introduce into the paper-based system, where the same information was spread across several ledgers and reports thusly:

▶ The monthly reporting system consisted of three different, distinct sets of reports—one for information on immunization progress, one for actual vaccination at facilities for different age groups, and one for vaccine supply:

◆ The immunization progress reports originated from the immunization register at commune health centers (CHCs) and were aggregated before submitting to higher levels.

◆ The reports on actual vaccination at the facilities were written after each immunization session during each month's immunization days; they were then finalized by age group (children under and over 1 year old) and included a report on anti-tetanus vaccination for women.

◆ The vaccine supply reports contained information about vaccine stocks and use, as well as orders for the next period. (It was, therefore, part of both the reporting system and the vaccine management system). Orders were based on scheduled immunizations, sent from the commune to the district levels, up to the provincial level, and finally to the national level, where the vaccine orders will be filled and distributed back down.

Part of this reporting system was computerized, down to the province level only, with a Microsoft Access-based tool. Some provinces may use Microsoft Excel- or Word-based tools for reporting at the sub-province level.

▶ The stock management system consisted of vaccine ledgers at all levels where stock was kept, as well as dispatch notes, vaccine arrival reports, packing slips, and bin cards. Only at the national level was this system computerized.

Vietnam took the first steps in 2012 toward digitalizing vaccine transactions from the national down to the commune levels and tracking immunization history at the individual level, as well as supporting health workers at all levels in aggregating data with the first version of ImmReg and VaxTrak, two precursor software applications used to register and track immunization and to track vaccine stocks and distribution, respectively. ImmReg and VaxTrak were piloted in select districts of Ben Tre Province in 2012 and then integrated and scaled up to the provincial level in 2013. Then the National Immunization Information System (NIIS) was introduced nationwide in 2017. The NIIS was developed by Viettel Business Solutions Corporation, Vietnam's largest mobile network operator company, backed by NEPI and supported by PATH. Within the framework of the Introducing Digital Immunization information systems: Exchange and Learning from Vietnam (IDEAL-Vietnam) project, funded by the Bill & Melinda Gates Foundation, PATH conducted interviews in two project provinces of Son La and Hanoi in Vietnam with immunization staff from different management and facility levels and used these interviews, together with findings from the Readiness Assessment report,⁴ to analyze the influence of the NIIS on the workloads of EPI staff at different phases throughout the process of moving to a completely paperless immunization reporting system.



2. Change of workload for immunization staff at facilities— direct point of care



2.1. At the CHCs

Without investment in cold chain supply and storage, which would enable a steady supply of vaccines, CHCs had to organize fixed-schedule immunization days every month – a monthly session-based system, to which all the children in a commune due for vaccination were invited and for which the estimated required vaccines were ordered and transported for those days only. Thus, Implementation of the NIIS significantly decreased the burden on immunization staff as far as processes and time required for planning, preparation, execution, and reporting (see Figures 1 and 2).

PLANNING FOR IMMUNIZATION SESSION

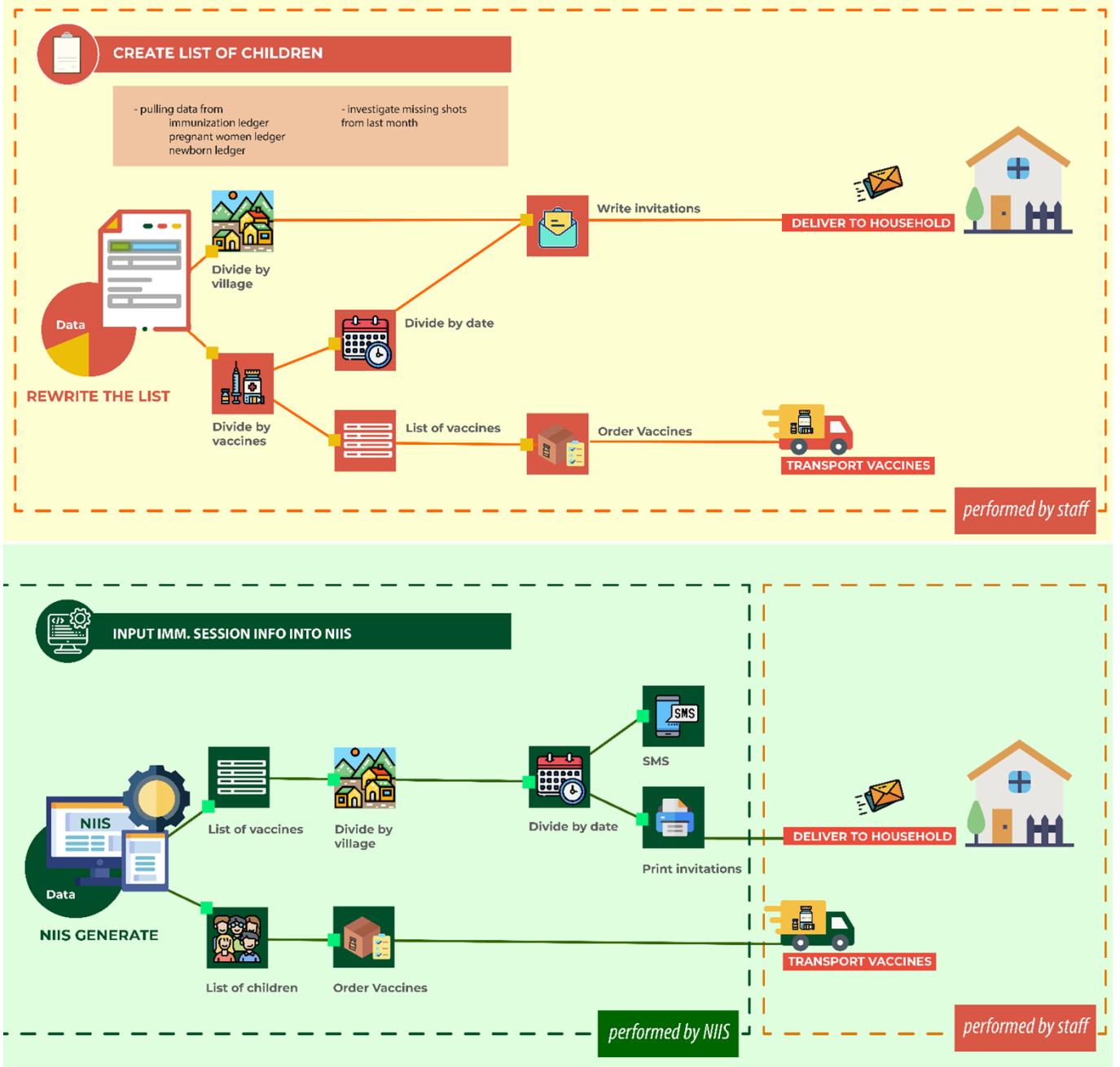


Figure 1. Processes for planning an immunization session at a community health center before and after the National Immunization Information System (NIIS).

VACCINE AND IMMUNIZATION REPORT

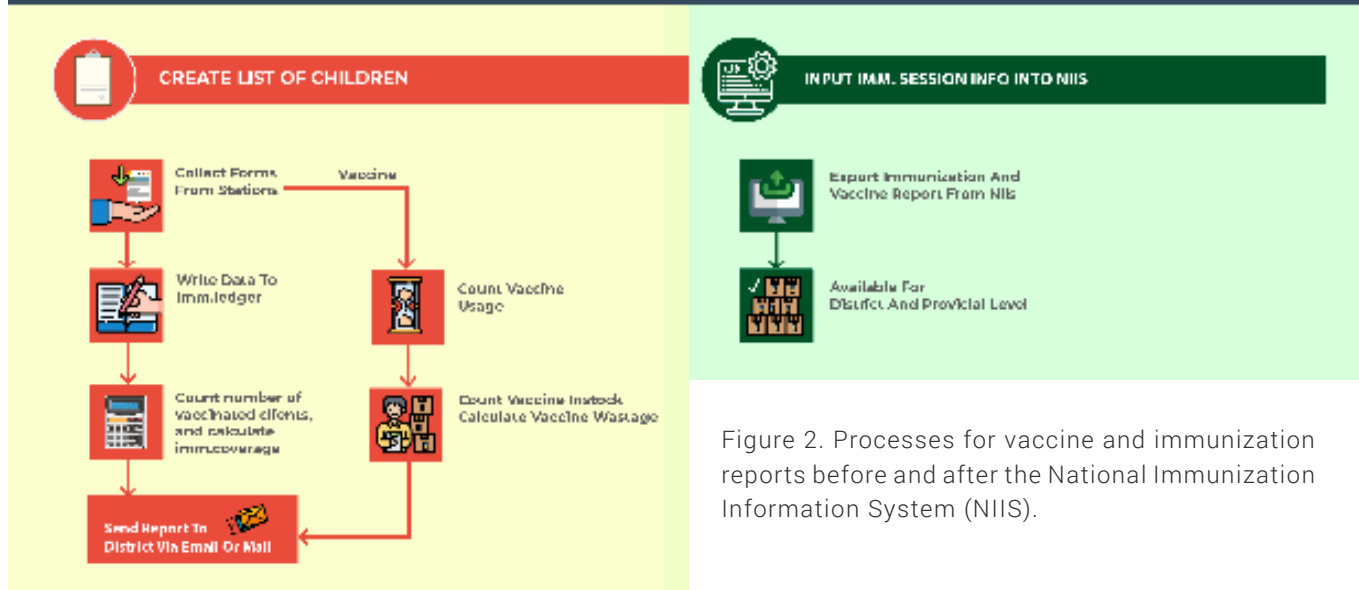


Figure 2. Processes for vaccine and immunization reports before and after the National Immunization Information System (NIIS).

For a more detailed elaboration on how the NIIS supports the immunization staff in planning and reporting, please see the Annex table on the comparison of the immunization staff’s workflow before and after the NIIS’s introduction.

Overall, our interviews reflected a number of findings from the Readiness Assessment, which demonstrated the significant reduction in time spent by immunization staff in both planning and reporting. Remarks from immunization staff elaborated more on their day-to-day work with the immunization program and how it has changed with implementation of the NIIS. The consensus was that workloads have been reduced significantly.

However, the majority of interviewees from the CHCs in the two project provinces emphasized the extra burden incurred during the initial phase of NIIS introduction and during the transition phase due to the following:

- ▶ Required trainings on the system and on the new four-step immunization procedure (welcoming, screening, injection, and post-injection follow-up) for using the system

and extra learning efforts required from the staff—which varied depending on the level of computer competency.

- ▶ Required backdated data entry (two years of data) of all children born since January 1, 2015, to create the foundation database for the system to function.

- ▶ Doubled workload with use of dual systems—paper and electronic—during the transition phase to cross-check and ensure data quality, which meant that the time consumption essentially equaled the time required for both systems.

These unavoidable burdens had to be recognized by the supervisors and upper-level management. They supported immunization staff by training other CHC staff as backups, assigning other staff to help with initial data input, and alleviating immunization staff of other tasks/projects that they were involved in so that they could focus on the immunization program.

“The job has become so much simpler with the assistance of [a] computer. However, automatically generated ... list[s] and reports still have some errors, [so] that I still have to call the parents to double-check on their information as it might not be updated in a timely manner, especially if they got vaccinated at the private clinic. I also have to edit the automatically generated reports as some new vaccines are not updated. So, it saved us time and effort but at the same time added ... other kind[s] of work, especially with our limited computer skill[s]. We are hoping for a more seamless system.”

—IMMUNIZATION STAFF AT A CHC.



“Looking back, the paper-based system for immunization was a nightmare; besides the official ledgers that we had to store and the reports that we had [to] submit to the district health center and [try] to keep ... clean, we had to write and re-write the lists of children and vaccines in our draft notebook, using all kinds of [stationery] available (different colored pens, pencils, markers, marking stickers, etc.) to differentiate groups of children and vaccines—that way, we could ensure to count correctly. Our notebooks were like colorful children[s] books.”

—IMMUNIZATION STAFFER AT A CHC.



2.2. At the fee-based immunization facilities (FIFs)

A previous IDEAL-Vietnam case study on engaging private-sector FIFs in immunization data management with the NIIS has presented a thorough analysis on the current status of FIFs in Vietnam.⁵ Some of the busier FIFs already have their own EIR system for managing registered clients. The interoperability between the NIIS and FIFs’ own EIR systems remains among the most challenging hurdles to engaging the FIFs in the new system. Until effective application platform interfaces are developed to automatically exchange data

from one system to the other, immunization staff at FIFs would have to input data in both systems simultaneously. The NIIS thus creates redundant double work for immunization staff, which is especially problematic for FIFs with a high daily volume of clients. Some FIFs would have to hire additional data entry personnel and performing double data entry manually would also lead to errors, inconsistency, and incompleteness in the database.

2.3. At the hospitals or clinics with birthing rooms:

Hospitals and clinics with birthing rooms manage birth registries and vaccinate newborns with the hepatitis B birth dose (within 24 hours of birth). They would typically have a birth ledger where they record the mothers’ demographic information (name, address, phone number, and insurance information) and the newborns’ health/physical status and demographic information (date of birth, gender, weight, length, etc.). After the hepatitis B birth doses are given, immunization staff will record these shots into a hepatitis B birth-dose ledger and provide the mothers with hepatitis B immunization certificates. These certificates are, essentially, the only information bridge between hospitals/clinics with birthing rooms and the CHCs, where the rest of the immunizations for the children will be managed. Information, thus, is handwritten and transferred from the birth ledger to the certificate and then to the immunization ledger at the CHCs. These small yet important pieces of paper are often crumpled, lost, or forgotten. Furthermore, if the mothers do not go to the CHCs in the communes where they are registered, the total number of newborns in the birth ledgers will not match the total number of children in the immunization ledgers.

Since the NIIS introduction, immunization staff at the hospitals/clinics with birthing rooms only have to enter information into the system once after they have administered the hepatitis B birth doses, information which is then available for all CHC immunization staff (even at different communes) to help provide continuous immunization service. The hepatitis B certificates are still printed out for the mothers, but only to help CHC immunization staff identify the children on the system more easily.

The NIIS also helped the reporting process at these facilities. All the reports—the birth report, the coverage report on hepatitis B birth doses, and the hepatitis B vaccine report—can be done with a click once the data are entered correctly into the system.



“Technical support [required] a huge effort from the upper-level staff. Most of them spent significant time in the CHCs to provide hands-on training and support [for] the basic computer skill[s]. Furthermore, transportation from one commune to the next, especially in the remote and mountainous areas, was not easy and could even be dangerous, with rain and storms. They often had to leave early in the morning and got back late and would be on call as needed.”

—PATH PROGRAM OFFICER WITH FORMERLY WITH IM-MREG AND CURRENTLY WITH IDEAL-VIETNAM PROJECT.

3. Change of workload for immunization staff at the management level at the district, provincial, regional, and national levels of the NEPI

Similar to the commune levels, the time spent for reporting at the upper levels has reduced significantly. At the time of the baseline survey, EPI staff (district, provincial, and national immunization staff) used either a calculator or computer to aggregate data from commune reports. For those using a computer, predesigned Microsoft Excel files allowed health workers to enter data from commune immunization reports, automatically generating results for the entire district. The process of compiling the report on vaccine use was more complicated. Health workers were seen pouring over the vaccine register, previous month's reports, and distribution vouchers, trying to reconcile data in order to provide an accurate report.

The provincial-level reporting staff must confirm data with each commune EPI staffer before entering the data.⁶ With the NIIS there is essentially no report from the district to the provincial levels as immunization and vaccine data are available for all levels.

However, introduction of the NIIS virtually turned EPI staff to “hotline” numbers 24/7 for lower-level immunization staff. They also serve as the bridge for directing feedback, concerns, errors, and bugs back to Viettel, the system developer. They have had to commit innumerable amounts of valuable time and be dedicated to this work.

The management workload of EPI staff, however, is evaluated not on the time spent but on the effectiveness of the immunization program under their jurisdictions.

Accordingly, the terms “data quality” and “data use” are given close attention by these health workers. Data can be used for effective program management (especially planning, monitoring, and evaluating the program effectiveness) only when the data quality is ensured.

The NIIS, in general, is deemed to provide more completed, timely, and accurate immunization and vaccine data.

The Readiness Assessment showed that data-quality feedback from end users in regard to the NIIS was very positive, with 80 percent of facilities reporting that the immunization data in the NIIS were accurate and aligned with the results from the paper system. When observed, children's demographic information overall was consistent between the two systems. Observation data support end-user feedback, with 91 percent of vaccination data consistent between the two systems.

Streamlining the systems also allows for review of data in submitted reports and cross-checking between different levels to spot discrepancies or errors to ensure data quality.

Based on these good-quality data from the NIIS, EPI staff can readily monitor and evaluate the system to identify:

- ▶ Gaps in resources between different localities to allocate resources appropriately.
- ▶ Weak spots in the human resource capacity of NIIS use to provide more technical support via supportive supervision, training, etc.

▶ Low immunization coverage points to investigate and create a subsequent action plan for improvement.

▶ Need for certain vaccination catch-up or other campaigns in certain areas. The list could go on, as EPI staff can now better explore the vast potential of full-fledged immunization data use.



“With the data from [the] NIIS, we can get timely information when things happen like last measles outbreaks. It also helped with picking the CHC or district to go [to] for supportive supervision instead of going randomly. Our work would be more focus[ed] and efficient. There [is] more I think we can do with the data on [the] system that I have yet to learn.”

—PROVINCIAL EPI STAFFER.



“The reports are quick and convenient to access; I can get data anytime anywhere with Internet connection, [so I] don’t have to wait till the monthly report.”

—DISTRICT EPI STAFFER.

4. Conclusions and recommendations



The NIIS, fundamentally, reduces the workload and increases efficiency for immunization staff at all levels:

- ▶ The automatically generated lists and reports on vaccines and children significantly reduce the amount of mundane labor required by paper-based ones, which took up enormous time and were prone to errors and inconsistencies. This reduction gives staff time to focus on improving the clinical aspect of immunization services to the clients. Good data for immunization and vaccine planning also help with reducing vaccine wastage.
- ▶ The timely, completed, and accurate data can provide essential information for upper-level staff making executive decisions on immunization programs, which could strongly enhance population coverage. Furthermore, with adequate training on and knowledge of the system, policymakers can execute regulatory oversight, protect and advance the public health through surveillance/monitoring, accelerate research, and disseminate new knowledge/evidence for immunization campaigns and outbreak response.

However, it has proven to be an ongoing process and continuously evolving throughout Vietnam's decade-long effort at EIR design, development, and deployment. EIR Implementers in other countries would need to carefully evaluate their countries' current landscape on infrastructure, human resources, and existing immunization systems. In this case study, with its focus on workload for immunization staff, it is essential to include in the timeline and appropriate planning the following phases:

- ▶ Introduction phase of the EIR system:
 - ◆ Sufficient training and time are needed for staff to get familiar with the system and use it efficiently and should be allocated specifically, depending on the computer

competency level of staff. The added workload burden of this training and learning for immunization staff should be considered.

- ◆ Entering backdated data is required and is, again, very labor-intensive, especially to those who are not yet familiar with the system.
 - ▶ Transition phase, with dual systems:
 - ◆ This extends the workload for immunization staff as they have to perform on both the paper-based and electronic systems, which doubles the work and is time-consuming.
 - ◆ As the NIIS is highly consistent with the paper-based system but nevertheless still has errors, time is needed to cross-check and find errors, which is an enormous and difficult task.
 - ◆ There should be a specific timeline and procedure laid out for transition to a paperless system, with a clear checklist and criteria for data quality, to ensure minimization of the period of doubled workload for immunization staff.
 - ▶ Paperless phase:
 - ◆ The EIR system should continue to change to adapt to updates in new vaccines, new regulations, and new procedures from NEPI.
 - ◆ Until the developer update reporting module has had time to conform to any such changes, immunization staff will need to be able to evaluate the data exported from the system, recognize discrepancies within the reports, and find the solutions to these issues.
- Furthermore, engaging private-sector providers should also be among the priorities, since the immunization database is only be completed with their engagement. Implementers should thoroughly consider during application platform interface and protocol development ways to avoid doubling the work for immunization staff and increase data accuracy.

ANNEX. IMMUNIZATION STAFF WORKFLOW BEFORE VS. AFTER THE NIIS IMPLEMENTATION.



Local / Project Officer involved in implementation



Computer software system implemented

PAPER-BASED SYSTEM

NIIS SYSTEM

✓ Planning



- Create a list of children in the commune who are due for vaccination in the month:
Go through the immunization ledgers, recorded by month of birth.
Write client information, contact information, missing shots in the month, and create the list, sorted by village and age group, according to the NEPI schedule.
- Check other sources/ledgers (e.g., for pregnant women and newborns, previous month's immunization list), paying attention to no-shows, ones unfit to get vaccinated, AEFIs, etc.
- Write invitations to children due and deliver to each child's house. Alternatively, inform community of immunization schedule through a communal loudspeaker, which provides general information about date and location but not specifically who are due for vaccination.

- Create a list of vaccines and amount needed based on the list of children due.
- Assign staff appropriately for the immunization session



- Select the start date, number of days for immunization session, what kind of vaccine CHCs will provide in the immunization sessions, and locations of vaccination, as well as staff assignment for that day
- The system will automatically generate the list of children that are due for immunization in that month, and will send SMS reminders
- For those who do not have mobile phones and/or did not register for the SMS reminder service, print out the invitations from the system and deliver them to the households in person.



Based on the generated list and session assignments, health workers can order vaccines—what kind and how many doses they will need per sessions per month.

✓ Preparation



- Photocopy or print out screening template form.
- Prepare for vaccine transportation (vehicle, cold chain storage, vaccine bin, etc.)
- Go to DHC to get the vaccines, cross check with the information on dispatch note at the DHC.
- Transport vaccines back to the CHC.
- Check required temperature, equipment condition upon arrival.
- Update vaccine and equipment information on the vaccine ledger.
- Arrange tables/stations at the CHC according to the 4-step procedure

- Order the vaccines at the district level.
- Transport them back to the CHC and manage the stock in and out via dispatch notes, packing slips, and arrival report.

- Set up the CHC for immunization day: stations for check-in, screening examination, vaccination, and post-vaccination follow-up.



- Prepare for vaccine transportation (vehicle, cold chain storage, vaccine bin, etc.)
- Go to DHC to get the vaccines, cross check with all information on dispatch notes at the DHC.
- Transport vaccines back to the CHC.
- Check required temperature, equipment condition upon arrival.
- Check the vaccine dispatch information on the system, lot number, vaccine name to ensure correct delivery prior to accept them on the system.
- Arrange tables/stations at the CHC according to the 4-step procedure

- Transport vaccines back to the CHC and manage them according to the system's data on tracking vaccines.

- Set up the CHC for immunization day: stations for check-in, screening examination, vaccination, and post-vaccination follow-up.



• Based on the list of children due for vaccination and session assignments, the system automatically sends SMS invitations to the parents who registered for the SMS reminder service; those who did not but who have smartphones and have installed the e-card app can receive notifications or receive messages through Zalo (most popular social media network in Vietnam).

• Vaccine orders are placed on the system so that district level will have access to.

✓ Execution



- Mobilize all the CHC human resources to execute the immunization activities following the 4-step procedure:
- Welcome table: greet and check-in the children, taking their vital signs, check their immunization records, and write down on the screening form.
 - Screening table: check their immunization card and cross check with the immunization list to determine what kind of vaccine is to be administered and then be screened by a doctor, who does a physical health check to ensure the child is fit for vaccination. All information is written down on the screening forms.
 - Vaccination table: Vaccinate per recommendation of doctor; and record the vaccines, lot numbers, date, etc. into the immunization card.
 - Post-vaccination follow-up: the children will be followed up for 30 min., and all the AEFIs will be recorded in the AEFI ledger and screening form



- Mobilize all the CHC human resources to execute the immunization activities following the 4-step procedure:
- Welcome table: greet and check-in the children, taking their vital signs, check their immunization records, and write down on the screening form. Screening form can be printed out with all the information for each child.
 - Screening table: check their immunization card and cross check with the immunization list to determine what kind of vaccine is to be administered and then be screened by a doctor, who does a physical health check to ensure the child is fit for vaccination. All information is input into the system.
 - Vaccination table: Vaccinate per recommendation of doctor; and record the vaccines, lot numbers, date, etc. into the immunization card.
 - Post-vaccination follow-up: the children will be followed up for 30 min., and all the AEFIs will be input into the system














Local / Project Officer involved in implementation



Computer software system implemented

PAPER-BASED SYSTEM

NIIS SYSTEM

			
<p>✓ Execution</p>	<p></p> <ul style="list-style-type: none"> • Ensure that at each station there is a pre-printed form for officers fill out with all the information that pertained to a particular child and collect these forms within the next 3 days after immunization session. 	<p></p> <ul style="list-style-type: none"> • Have, ideally, a computer at each station to input data right into the system, following the above 4-step procedure (though the majority of CHCs only have 1 to 2 computers, requiring that some information have to be collected on paper/forms, and entered into the system later) 	<p></p>
<p>✓ Report</p>	<p></p> <ul style="list-style-type: none"> • Compile the filled-out forms collected from different stations and ensure the information regarding the injections are handwritten into the immunization ledgers. • Count the number of forms collected and the number of vaccinated children on the ledger (cross-checking data); calculate the coverage in the commune to formulate into a monthly immunization report to send to the district level via both email and signed/stamped hard copy via postal service • Count the vaccines based on the immunization forms, and then count the vaccines remaining in stock to cross-check the reality of vaccine usage, lost, damaged; Calculate the rate of vaccine wastage and formulate into the monthly vaccine report to send to the district level via both email and signed/stamped hard copy. 	<p></p> <ul style="list-style-type: none"> • Cross-check actual number of injections on immunization day with remaining vaccines in stock to ensure data were entered into the system completely, accurately. • If there are discrepancies, ensure immunization officers are able to recognize, evaluate, and resolve the issues. 	<p></p> <ul style="list-style-type: none"> • System automatically generates and sends reports on immunization and vaccines to the district level on the 5th of each month (due date for reports). • The system provides real-time data so that when data are entered into the system at the commune level, higher levels can see the results.



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