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# A Gavi, the Vaccine Alliance Look Back and Forward: District Health Information Software 2 (DHIS2) for Immunisation

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## Acronyms

| | |
|---|---|
| AEFI | Adverse events following immunization |
| BMGF | Bill and Melinda Gates Foundation |
| CDC | U.S. Centers for Disease Control and Prevention |
| CRVS | Civil registration and vital statistics |
| DHIS2 | District Health Information Software 2 |
| DHS | Demographic and Health Survey |
| DVDMT | District Vaccination Data Management Tool |
| eLMIS | electronic logistics management information systems |
| EIR | electronic immunisation registry |
| EPI | Expanded Programme on Immunisation |
| FOSS | Free and Open-source Software |
| Gavi | The Vaccine Alliance |
| GIS | Geographic information systems |
| HMIS | Health management information system |
| HSS | Health Systems Strengthening |
| HISP | Health Information Systems Programme |
| ISDR | Integrated Disease Surveillance and Response |
| IVB | Immunisation, Vaccines and Biologicals |
| JSI | John Snow, Inc |
| LMIC | Low- and middle-income country |
| MICS | Multiple Indicator Cluster Survey |
| MOH | Ministry of Health |
| PEPFAR | President's Emergency Plan for AIDS Relief |
| RI | Routine immunisation |
| SI | Strategic Investments |
| SFA | Strategic Focus Area |
| SWOT | Strengths Weaknesses Opportunities and Threats |
| TA | Technical assistance |
| TCA | Targeted Country Assistance |
| UiO | University of Oslo |
| VPD | Vaccine-preventable disease |
| WHO | World Health Organisation |

## Executive Summary

Gavi, the Vaccine Alliance's (Gavi's) strategic decision to support countries that wanted to transition from parallel immunisation reporting systems to support the integration of immunisation data into the national HIS has been well received by the global community. District Health Information Software 2 (DHIS2) has become an important platform within many national health information systems (HIS) in low- and middle-income countries (LMICs). The extensive scaling can be attributed to years of community building, strong regional support mechanisms, and long-term systematic country capacity building that contributes to sustainability. In more than 40 Gavi-supported countries, the DHIS2 platform is used as the national HMIS.

The development of standard global metadata packages for DHIS2 for immunisation led by the World Health Organization has contributed to increased data standardisation and data availability at country level. Overall, the transition from data availability to data use has been more challenging, but there are some emerging country success stories – including some that are reporting upwards of 90% data completion and the effective use of data for programme planning and monitoring. Countries with more mature DHIS2 implementations and strong relationships between the Essential Programme for Immunisation (EPI) teams and HIS teams are more actively using DHIS2 for programme monitoring, planning, and reporting internally and to Gavi and WHO as well as extending the functionality to support a broader range of immunisation use cases like immunisation campaign monitoring. Countries with limited engagement by EPI with DHIS2 activities have struggled to use DHIS2 effectively to support the immunisation programme. In addition, learnings from more successful country implementers of DHIS2 point towards solid governance and donor coordination, culture of data use at sub-national level with positive sense of data ownership for improved decision making, and inclusion of DHIS2 in Health Systems Strengthening (HSS) Plans.

The three tiers of support provided by Gavi – global (support to WHO, UiO, and UNICEF), regional (WHO-Afro and HISP) and country-level (through Health Systems Strengthening Grants) is a good model and well- appreciated by country stakeholders, Alliance members and other DHIS2 funders, including the Global Fund which has also been supporting country implementation in a coordinated manner. While Covid-19 helped WHO-Afro to support countries to increase adoption of DHIS2 immunisation packages, it has also hampered their active engagement in the coordination of technical specifications for immunisation module development and testing. It is recommended that the model be replicated in other regions where there is already demand from Gavi-supported countries and regional offices of WHO and UNICEF. Based on learnings from global package development and implementation, there are also recommendations for more rigorous user-centred design, testing, and updating process with EPI managers and staff at all levels (especially sub-nationally at district and facility levels) to improve user-friendliness for those entering and/or using the data.

A comprehensive list of recommendations has been developed through this review with some of the overarching ones highlighted here in the executive summary. While perceived as modest compared to other funders, Gavi's growing support for DHIS2 is coming close to the major traditional funders, namely the Norad, United States President's Emergency Plan for AIDS

Relief (PEPFAR), Global Fund. As such there is greater need to support donor coordination efforts in alignment with the Principles for Donor Coordination in Digital Health as well as Global Goods, and to advocate for and monitor the application of the Principles for Digital Development in all aspects of design, implementation, and evaluation by UiO in its stewardship over DHIS2. This will strengthen the effective use of DHIS2 immunisation global packages and promote harmonization of DHIS2 with other digital health platforms, especially eLMIS, at the country level.

Gavi's investment in DHIS2 for programme planning, implementation, and monitoring is significant overall and requires additional support for coordination by the Secretariat. Despite limited funding on a country-by-country investment basis, countries with more actively engaged Senior Country Managers and M&E focal people were among the most successful in harnessing the full capacity and innovating on DHIS2 in a way that enables countries to use the data for program planning and reporting to Gavi, providing near real-time data for monitoring of Gavi investments. As such, it is recommended that Gavi engage in sharing of experiences across country managers and internal capacity strengthening activities.

For countries, there is both pressure and the desire to transition to case-based surveillance and immunisation registries. However, it is strongly recommended that countries have strong aggregated data systems in place before transitioning to case-based platforms. In addition, for countries trying to overcome the greatest challenges will require support and coordination among donors for enablers such as building a culture of data use, leadership and governance, capacity with high staff turnover, master facility lists, and connectivity to ensure scale and effective use of data for immunisation.

At the regional level recommendations include investment in regional instances of DHIS2 to enable WHO regional offices to plan for and monitor activities as well as to support countries more effectively. Globally, there is a need for continued donor coordination as well as targeted investment in evaluation to better understand what constitutes effective use, which outcomes are most impacted by DHIS2 and why some countries are more successful than others.

Gavi's investment in DHIS2 for immunisation serves as a foundation in digital health and data to improve immunisation outcomes. It offers both concrete pathways for how to invest in and/or interoperate with other digital health tools and lessons learned in a way that can contribute to Gavi's aim that every child is fully immunised with a special emphasis on identification and vaccination for zero-dose children.

## Background

Gavi, the Vaccine Alliance (Gavi) as part of its Data Strategic Focus Area (SFA) has engaged the World Health Organization (WHO) and UNICEF along with a broad range of Alliance partners and donors to collaborate with the University of Oslo to integrate functionality in to DHIS2 that can help countries manage and monitor their immunisation programmes more effectively. This partner support began in 2016 and has led to the development and implementation of DHIS2 immunisation packages available through the WHO website.

As part of a broader review of the Data SFA within Gavi 4.0 and in preparation for new funding allocations for DHIS2 in alignment with the Gavi 5.0 Strategy, Gavi has commissioned HealthEnabled to conduct this Look Back and Look Forward Review to document lessons learned from past investments and align future activities with the Digital Health Information Strategy and Gavi 5.0 focus on zero dose children.

DHIS2 is an electronic Health Management Information System (HMIS) developed by the Health Information Systems Programme (HISP) at the University of Oslo (UiO). It was designed to collect routine data from health facilities to support decentralised decision-making at the district and facility level and serves as a tool for validation, analysis, visualisation, and sharing of health system data. DHIS2 is a software platform that can be configured to support a variety of uses cases, as well as built upon with custom apps or features developed outside of the DHIS2 core team, using the API and Android SDK. The DHIS2 data model supports both aggregate and individual-level data — including features for monitoring and following up with individual people or entities over time — and online and offline data entry via the DHIS2 web portal, mobile Android app, SMS, or direct import. It is a free and open-source software (FOSS) that can be tailored to the data collection needs of each country.

*"The overall vision for DHIS2 is "information for action." The Health Information Systems Programme (HISP) at the University of Oslo (UiO) developed DHIS2 to give countries a platform to capture and use their own data. In the early days, DHIS2 evolved and developed organically and has been mostly country-driven rather than donor driven." – Key informant*

## Methodology

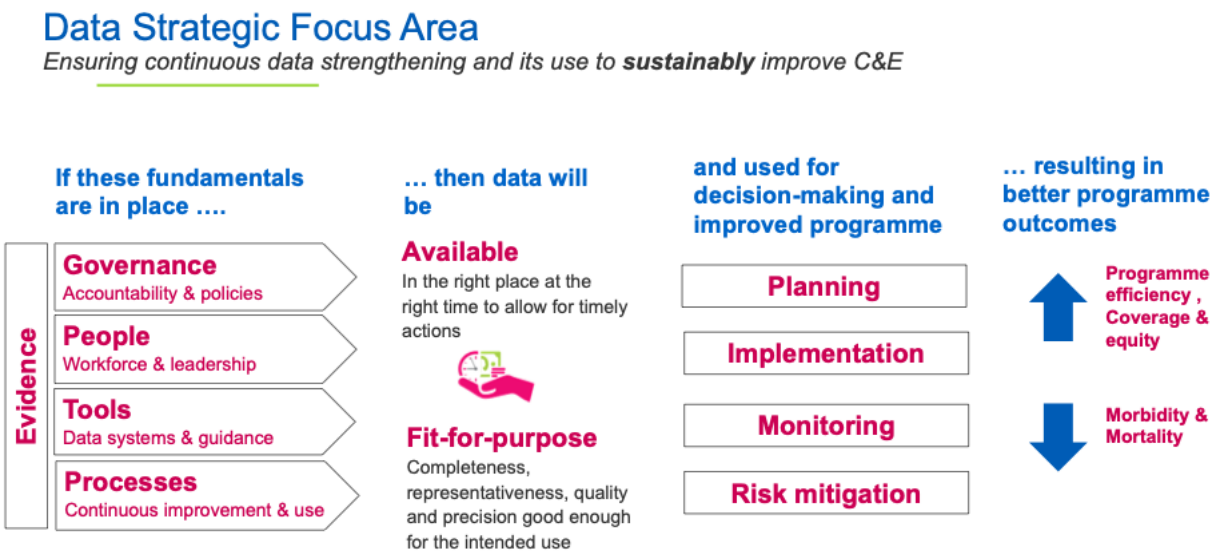
This review process involved a document and literature review on the use of DHIS2 for immunisation as well as over 20 key informant interviews with stakeholders involved in various aspects of DHIS2 and immunisation. In addition, country insights have been collected over the past year as part of a broader HealthEnabled DHIS2 and immunisation assessment, resource curation, on-line survey, and case study development effort. This process began with the WHO African regional workshop convened in Kigali, Rwanda entitled, "DHIS2 Experience sharing and Learning in the use of DHIS2 Immunisation App in the African Region workshop" that took place from 28th – 31st January 2020. The workshop attracted 64 participants from National Ministries of Health in Uganda, Kenya, Mali, Cameroon, Ghana, Nigeria, Rwanda, Togo and Democratic Republic of Congo and partners including Gavi, WHO, University of Oslo, JSI, CDC and PATH and provided significant insights into the achievements, challenges, and recommendations integrated throughout this report. The findings are presented in eight main sections of this report:

1. Historical Progression of Gavi Investments in DHIS2
2. Achievements to date
3. Review of the Literature
4. Gavi within the DHIS2 Donor Landscape
5. Strengths Weaknesses Opportunities and Threats (SWOT) Analysis of Gavi Investment in DHIS2
6. DHIS2 and Immunisation Theory of Change
7. Alignment with Gavi 5.0 Digital Health Information Strategy
8. Recommendations

## Historical Progression of Gavi Investment in DHIS2

Gavi's Data 4.0 Strategic Focus Area (SFA) was largely focused on increasing data availability and use. At the highest level, the Data SFA set forth to "ensure continuous data strengthening and its use to sustainably improve coverage and equity". Significant efforts were made to increase data availability within most Gavi country programmes. Some countries also demonstrated the effective use of data for planning, implementation, monitoring, and risk mitigation with a subset demonstrating how data and technology were effectively used to improve immunisation outcomes.

### Gavi 4.0 2016-2020 Data SFA Theory of Change




When mapping the experience against the Data SFA Theory of Change, DHIS2 fit into the Tools category that then led to increased availability of data with some but fewer than anticipated demonstrations of data use and no documented linkages to programme outcomes. The review of country experiences highlighted key challenges related to DHIS2 included Governance, People, and Processes as enablers of DHIS2 as a Tool.

These aligned with the challenges encountered in scaling up other Tools that were prioritised by the Gavi 4.0 Data Strategy including country readiness, lack of norms and standards, limited evidence and evaluation, and poor IT infrastructure and connectivity. To address some of these, Gavi leveraged Data Strategic Investment funds to support the development of country readiness assessments tools, the development of standards, assessments and research, and support for off-line solutions. These investments enabled countries to transition to a single immunisation reporting system using DHIS2 and to expand beyond aggregated health information systems data at national level to sub-national and individual level data systems and mature towards more programmatic use of technology and data. They also highlighted the need for continuous focus on enablers and coordination alongside prioritised digital health investments.

In a Lookback Review of the Gavi 4.0 Data SFA Strategic Investments (SI) conducted concurrently by the Kati Collective, they mapped out a timeline and documented an evolution in investments over time along with the relevant stages, activities, stakeholders engaged, and the enablers and disablers. Key high-level challenges and opportunities included:

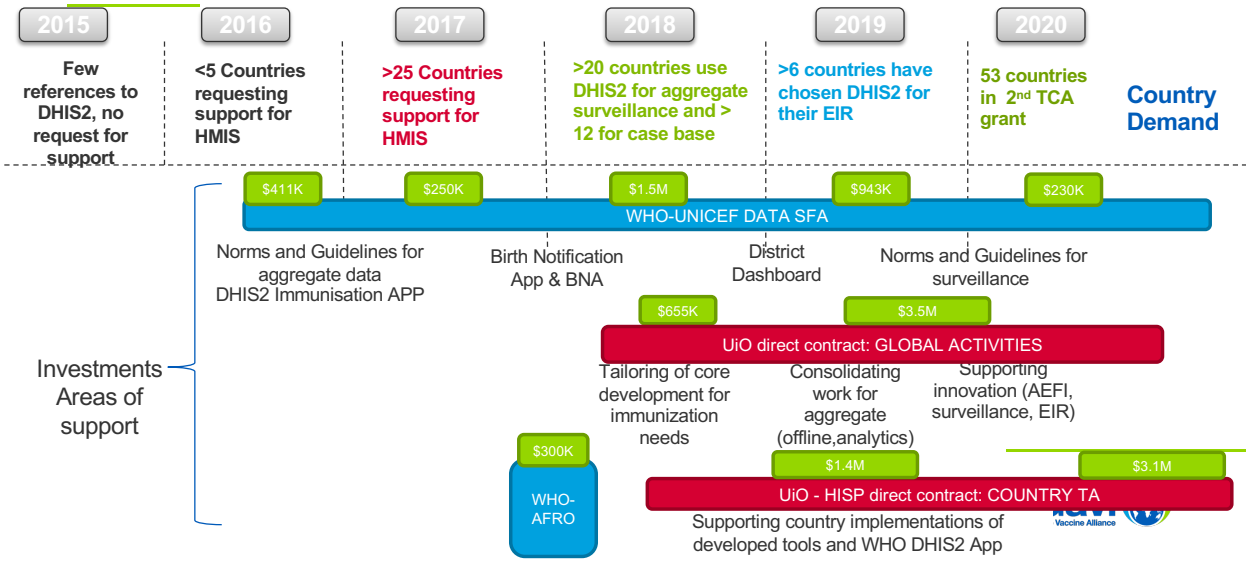
1. **Data SFA SI Strategy and Theory of Change**
2. **Aligning Strategy and Activities Across all SFA areas and Other Gavi Funding Streams**
3. **Country level Engagement in SI Data Strategies**
4. **Funding Cycle and Timing**
5. **The Leveraging the Unique Assets of Each Partner**
6. **Ownership on Priority Setting and Decision Making**
7. **Results Framework**
8. **Feedback and Reporting**
9. **Checks and Balances and Accountability Mechanisms**
10. **Engagement of Expanded Partners**

In comparison to other Data SFA Strategic Investments, DHIS2 investments and activities were more streamlined and were adapted over time. The Kati Collective review highlighted it as a model for how future data initiatives could be organised. The ones highlighted above in purple were reinforced in the DHIS2 review process and discussed in more detail below.

> *DHIS-2 strategy and activities led by the University of Oslo in collaboration with Gavi and the different core partners, may serve as a model into how to frame solutions funded by Data SFA SIs with country needs and directly link TCA and HSS funding to implement and scale those solutions nationally.*
>
> *– Kati Collective Recommendations Workshop Pre-read*

DHIS2 was not included in the original Data 4.0 strategy, and Gavi's initial approach to DHIS2 was responsive to country requests and largely catalytic. It began at a time when many countries were transitioning to DHIS2 and the immunisation programme was slower than other health areas in its integration of data into the national HIS. Many countries were trying to use DHIS2 for immunisation, but it was messy at first as local TA was not sufficient and uncoordinated and did not generally involve the EPI programme managers. Other financing partners – such as The Global Fund – were earlier in investing significant funds to support the move to DHIS2 as country monitoring and reporting systems for Malaria, TB, and HIV were less mature than immunisation. As illustrated in the timeline, country demand increased exponentially since 2016. As of June 2021, there are 54 countries eligible for TA support and 92 countries eligible for Covid-19 emergency technical support.

# History of Gavi Catalytic Investment in DHIS2




| DHIS2 immunisation packages and apps | |
|---|---|
| WHO Data Quality App | A custom web app in DHIS2 used to improves the quality of data used for analysis and decision making by identifying potential errors and gaps (designed according to WHO Data Quality Review Framework) |
| WHO EPI Module | Standardized data elements, data sets, indicators, and dashboards for routine reporting and analysis of immunisation data, with a focus on facility-level data. This module includes vaccines administered, coverage rates, facility stock reporting, cold chain monitoring and wastage. |
| WHO Immunisation Analysis App | A custom web app in DHIS2 to support enhanced analyses and data visualisation for EPI program monitoring and planning |
| Bottleneck Analysis (BNA) App | An installable web app for performing bottleneck analyses on programmes to identify, analyse, and resolve immunisation programme bottlenecks. |
| Scorecard App | An installable web app for creating scorecards for immunisation programmes or other health interventions. Can be used alone or with the BNA app. |
| Child Immunization Registry (not funded by Gavi) | An extension for DHIS2 that allows the collection, management, and analysis of transactional, case-based data. Using DHIS2 tracker data as the model for longitudinal individual level data, this module is designed for clinicians and staff at health facilities. It enables tracking of a child's immunisation history with built-in reminders to track and follow-up with defaulters. The module supports WHO-recommended immunisation schedule and can be adapted according to national |

| | |
|---|---|
| | policies / schedules. It includes indicators that are autogenerated and pre-mapped to monthly facility reporting indicators included in the aggregate EPI package. |
| Integrated Disease Surveillance & Response (IDSR) | Supports weekly IDSR reporting for notifiable diseases, dashboards, and alerts. Many countries in Africa use DHIS2 for IDSR reporting. This module supports standardization of definitions, alert thresholds, etc. according to WHO guidance. |
| Vaccine-preventable disease (VPD) Case-based Surveillance | Enables longitudinal capture of case data; linking clinical, laboratory, and case outcome data to a case. The tracker currently supports nine diseases and can be expanded to capture additional diseases. |
| Adverse Effects Following Immunisation (AEFI) | Case-based module to enable the notification, investigation, reporting, and analysis of adverse events following immunisation and provides mechanism for case-based surveillance of AEFI. |

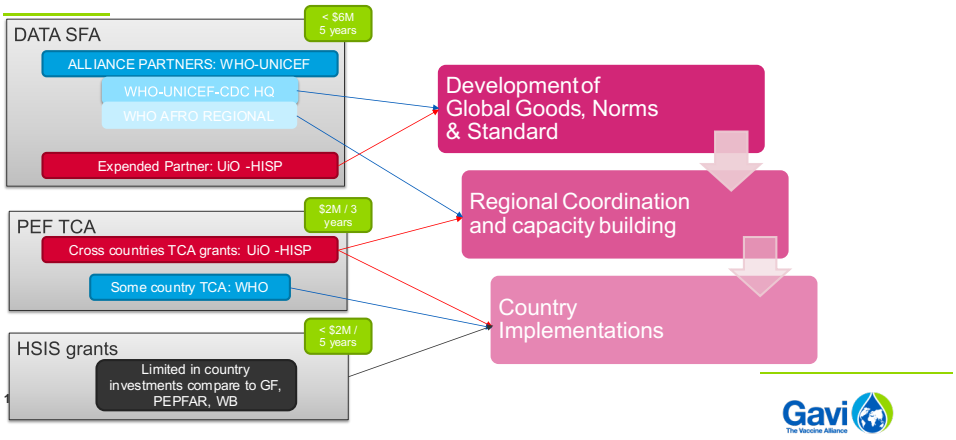
For more information, visit: https://dhis2.org/immunization/

DHIS2 has also been used for real-time monitoring of immunisation campaigns, and a module to facilitate this is currently under development.

Gavi's investments related to DHIS2 are being provided at three levels:

1. Global level for the development of immunisation packages with UiO, WHO, UNICEF and other technical partners.
2. Regional level with support to WHO-Afro and UiO and HISP to support country implementation of packages and to serve as a bridge to bring country perspectives into the development of standard immunisation packages and to UiO and HISP to support country implementation of packages.
3. Country level with direct funding to countries and support through partner organisations to implement packages. This has been very well received especially in countries outside of Africa.

**DHIS2 investment strategyuses all PEF and HSS opportunities, supported by a mix of Alliance and Expanded partners**




The perception of Gavi's early support for DHIS2 by external stakeholders (donors, technical partners, and countries) is mixed. It started in 2016 a contribution alongside Global Fund and other donors to the development of the Data Quality module with WHO. Immunisation partners were not well consulted as part of the process that was led by the data-focused workstream at WHO. A tool was developed that was not well aligned to country immunisation programme needs and/or circumstances. Some countries had already been using DHIS2 for immunisation, but overall interest from immunisation programmes was low (less than 5 countries had asked for support from Gavi).

In 2016, at a workshop organised by WHO-Afro Immunisation, Vaccines, and Biologicals (IVB) in Kampala, key bottlenecks with the integration of immunisation into DHIS2 were identified and governing principles established for the integration. In 2017, 25 countries requested support from Gavi related to DHIS2, mainly to facilitate a generally difficult transition from the District Vaccination Data Management Tool (DVDMT) to DHIS2. Prior to 2018, Gavi's support for DHIS2 was through WHO and UNICEF. This shifted in 2018, when Gavi began to fund UiO directly for global activities and UiO and HISP alongside WHO Afro for Country Technical Assistance (TA). Many of the immunisation-specific DHIS2 products were built on existing DHIS2 functionality. Through collaborations with WHO and the UiO, complementary investments were made to develop and support implementation of a range of immunisation modules within DHIS2.

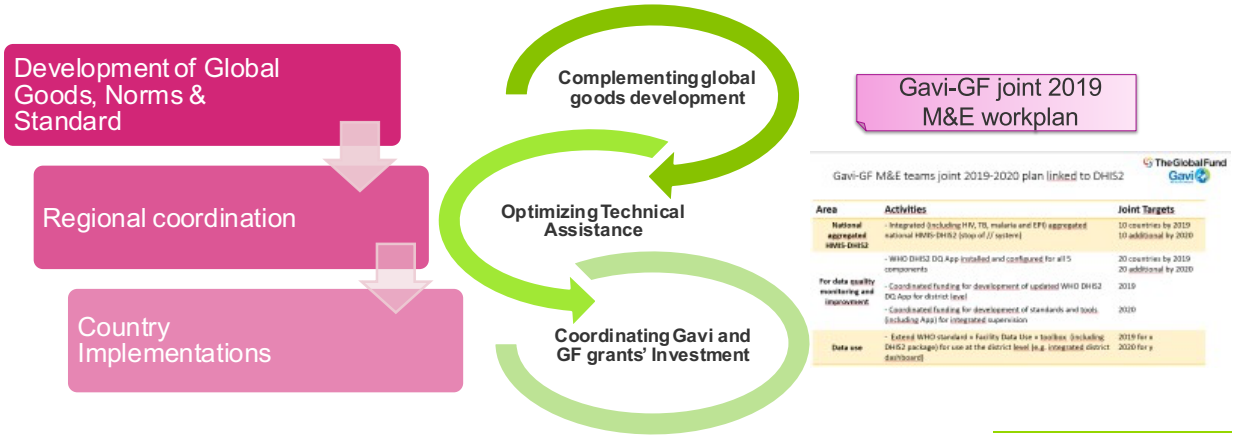
At all levels the work of Gavi has been well coordinated and designed to build on and complement Global Fund investments. At the global level, this has been done with the global packages beginning with the Data Quality App. At the regional level, Global Fund has leverage Gavi support to UiO and WHO-Afro to support regional coordination. At the country level, the Gavi TA mechanism is more agile and helps to support the funding Global Fund provides through their HSS grants. This was then supported with a joint M&E plan.

These catalytic investments were made alongside non-DHIS2 digital health solutions to test electronic immunisation registries (EIR), electronic logistics management information systems (eLMIS), and geospatial information systems (GIS).

## Gavi-GF M&E teams joint 2019-2020 plan linked to DHIS2

| Area | Activities | Joint Targets |
|---|---|---|
| **National aggregated HMIS-DHIS2** | - Integrated (including HIV, TB, malaria and EPI) aggregated national HMIS-DHIS2 (stop of // system) | 10 countries by 2019<br>10 additional by 2020 |
| **For data quality monitoring and improvment** | - WHO DHIS2 DQ App installed and configured for all 5 components | 20 countries by 2019<br>20 additional by 2020 |
| | - Coordinated funding for development of updated WHO DHIS2 DQ App for district level | 2019 |
| | - Coordinated funding for development of standards and tools (including App) for integrated supervision | 2020 |
| **Data use** | - Extend WHO standard « Facility Data Use » toolbox (including DHIS2 package) for use at the district level (e.g. integrated district dashboard) | 2019 for x<br>2020 for y |

## Coordination with the Global Fund is enhanced fomutual and countries benefits

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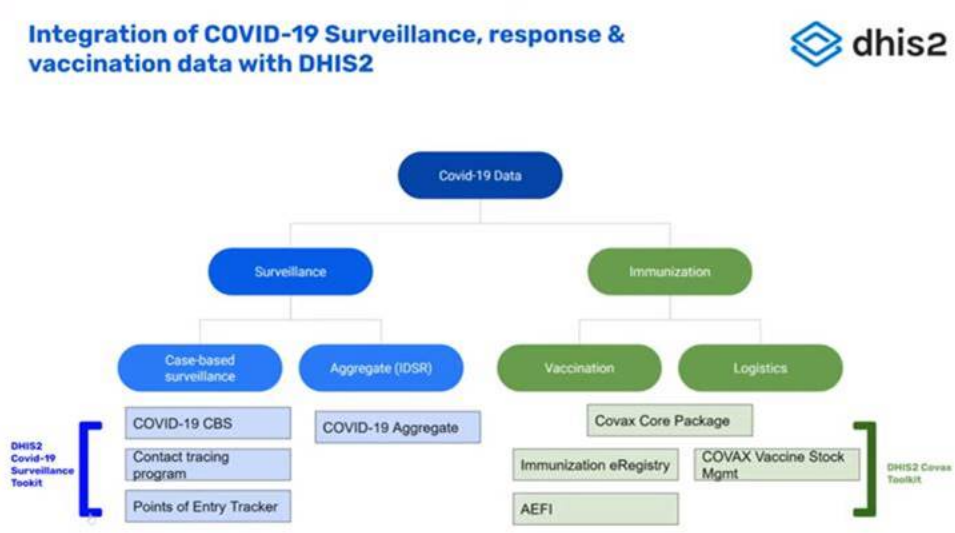
## Achievements to date

The Gavi support for DHIS2 enabled the development of a comprehensive suite of standard global immunisation packages. The various packages have been perceived to have varying levels of success in the design, development, implementation and uptake.



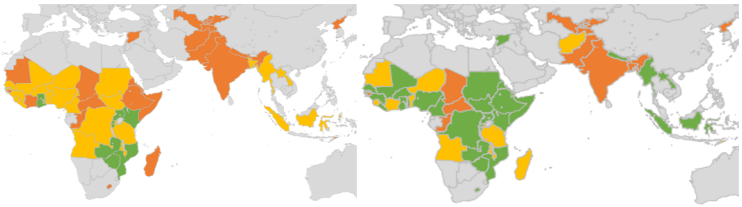

In addition to the development of the immunisation packages, as of April 1, 2021 - the main achievements of DHIS2 adoption and use include the following:

- **35** countries received technical assistance through HISP/UiO with 52 countries now requesting TA.
- Country adoption of the following global immunisation packages:
  - Data Quality App – **35** countries
  - EPI Dashboard – **33** countries
  - Immunisation Data Analysis App – **30** countries
  - DHIS2 Covid-19 surveillance package operational - **38** countries including **25** Case Base Surveillance
  - New modules for AEFI: 13 countries + Covid19 AEFI; on-going roll out in coordination with VIGIBASE.
  - Immunisation eRegistry – Rwanda national rollout
  - New DHIS2 Integrated Disease Surveillance and Response (IDSR) module: 14 countries planned
  - Real Time Planning and Monitoring of immunisation campaigns: Uganda and Bangladesh
  - COVID19 Vaccines: 24 countries using COVID19 Vaccines modules, including Delivery; 25 countries with at least one module installed; 23 with DHIS2 tracker for vaccine registry

- Website and Community of Practice - https://www.dhis2.org/immunization
- An additional 23 countries transitioned from parallel systems to immunisation fully integrated into DHIS2 and parallel system stopped (from 8 countries in 2018 to 31 in 2020)
- 9 countries exchanged experiences at WHO-Afro Workshop in Kigali- January 2020

Immunisation data integrated into DHIS2 in some countries

Baseline: June 2018 As of January 2021



| | No | Initial transition | Fully integrated and parallel system stopped |
|---|---|---|---|
| Baseline June 2018 | 25 | 23 | 8 |
| January 2021 | 13 | 12 | 31 |

Countries are reporting increased data completion, timeliness, quality, and use at sub-national and increasingly at the facility level (aggregate) with some moving towards individual data with DHIS2 tracker as an immunisation registry and for case-based surveillance. In addition, countries have highlighted the additional benefits of being able to develop a Master Facility List within DHIS2 that can be used for other digital health services and using DHIS2 for supportive supervision in immunisation service delivery. While there are many country success stories, this report includes some illustrative examples that demonstrate key aspects of DHIS2 uptake and use at the country level- including data availability and use, data quality, and innovative extensions of DHIS2 to new use immunisation use cases. In addition, an on-line survey conducted March 2020 provides additional insights into the adoption and use of DHIS2 for immunisation by countries and development partners.

### Myanmar Country Case Study

Myanmar provides an example of a country that successfully leveraged all available support to sequence sustained funding to roll-out DHIS2 use for immunisation.

In 2017 Myanmar began using the WHO Data Quality App to conduct a Data Quality Assessment and develop a Data Quality Improvement Plan. The implementation of this plan was supported with HSS funds in 2018. This led to improvements in data availability and use. Efforts were made to improve EPI's collection and use of real-time data at sub-national level, resulting in shorter lag time (4 weeks) in data availability at the national level. This has led to near-real-time data use for problem identification and resolution.

Sustained challenges are related to denominators for immunisation target setting and microplanning. There is interest in triangulation of DHIS2 data with CRVS data to link birth cohort numbers with immunisation coverage targets more directly. There is also fragmentation at the country level with donor support for relevant digital health platforms like eLMIS. The country needs guidance to support the selection process. A recommended resource for eLMIS selection is:
Guidance Developed by Global Fund and Gavi for the Selection of an Electronic Logistics Management Information System

While it is useful to know how many countries are using each of the global packages, it will be important for Gavi to also clarify how often and how well users are engaging with each of the packages at each level of use. This type of system data will enable better understanding of uptake of the packages and more informed decisions about how best to support countries and potentially make certain packages part of the Gavi reporting requirement.

**Nigeria's national roll-out experiences**

Deployment of the Routine Immunisation module for DHIS2 was in direct response to challenges and capabilities lacking in the previous data collection systems with the goal of making high quality data available in a timely manner for performance monitoring and to make improvements in immunisation coverage.

Funding and support from BMGF and CDC was combined with technical support from national and regional partners for the design and roll-out of the RI module. Immunisation programme success to date include:

- 80-90% Reporting completeness since 2018 immunisation dashboards
- Improved data quality and accuracy since 2019 DQA Module
- Harmonisation of all data sources after successful transition from DVDMT to DHIS2
- Data used at national level to target supportive supervision
- Government ownership and management of the platform and data

Reliable and committed government funding at both national and state levels remains a challenge to ensure sustainability of the system. (Shuaib et al., 2020)

In addition, countries like Bangladesh with a longer history of DHIS2 implementation as the national HIS have also been able to innovate in their effective use of DHIS2, extending functionality to new use cases like immunisation campaign monitoring (while not implementing some of the other immunisation packages).

**Bangladesh Real-time Monitoring of Measles-Rubella Campaign**

At the end of 2020, the national measles-rubella campaign in Bangladesh was presented with new challenges from the Covid-19 pandemic including changes in vaccination sites due to school closures and the need for enhanced health worker protections. The health system drew from a decade of experience using DHIS2 as the primary health management information system to use integrated digital data collection tools with DHIS2 to implement the first purely digital immunisation campaign in the country's history. Even though health facility providers and managers had high levels of capacity and familiarity with DHIS2, digital data entry and data analysis, a cadre of 50,000 community-level users received training before the campaign. The pre-campaign cascade training, field-testing of entry and reporting systems, development and refinement of the tools and systems took almost six months, with refresher training immediately before the campaign was able to take place in December 2020. The use of DHIS2 systems supported the pre-campaign planning process by creating target population estimates for each of the over 400,000 vaccination sites and integrating the supply chain and logistics planning with human resources needs for each location.

During the campaign, site supervisors used the Android Capture app to feed reporting and monitoring data directly into the DHIS2 platform that enabled real-time monitoring of campaign progress, achievements and areas for improvement. This system was also used to record vaccinator attendance, AEFI reports, cold chain temperature data and other logistics data throughout the campaign. Data on post-campaign verification through house-to-house visits and rapid convenience monitoring was transmitted from the Android mobile devices directly into the DHIS2 system to verify the coverage and success of the campaign and facilitated rapid response for mop-up activities in areas with low coverage. The culmination of these training, planning and integration

efforts resulted in the vaccination of 98.1% of children in the target age group. With technical support from UiO and UNICEF, the EPI Programme was able to achieve high coverage rates but also created a foundation of systems, capacity and transparent, reliable data to inform future campaigns.

References:
Shahed, J. 2021. *Bangladesh is the first country to use DHIS2 in planning, implementing, and monitoring MR campaign in largest scale*. User story on the DHIS2 community forum. https://community.dhis2.org/t/bangladesh-is-the-first-country-to-use-dhis2-in-planning-implementing-and-monitoring-mr-campaign-in-largest-scale/42408

UNICEF-ROSA. 2019. Health System Strengthening: Transforming the health information system in Bangladesh: Case Study. https://www.unicef.org/rosa/reports/health-system-strengthening-transforming-health-information-system-bangladeshhttps://www.unicef.org/rosa/reports/health-system-strengthening-transforming-health-information-system-bangladesh

Public dashboard with data from Bangladesh Dec 2020 MR campaign http://103.247.238.92/mrcampaign/public/

## Country Challenges

Alongside successes, many countries face infrastructure challenges, unreliable internet connectivity, and limited computer equipment and technical support systems. The following table highlights some of the recommended solutions from more mature countries for persistent challenges faced by countries as identified during the Kigali workshop.

| Challenge | Proposed Solutions |
|---|---|
| **Top-down approach** | • Understand the needs of the operational level managers and health workers<br>• Link data to resource allocation and management |
| **Limited data use as a result of:**<br>• Limited capacity/ skills at the lower levels on data analysis<br>• Indicators and processes not standardized<br>• Weak monitoring of indicators and irregular supervision | • Guidance on linking data analysis and actions<br>• Continuous training<br>• Consult the users on the system design<br>• Simplify tools with standardized indicators and processes<br>• Continuous follow up, mentorship and integrated supportive supervision<br>• Periodic or routine data sharing with top management |
| **Leadership issues that lead to implementation of DHIS2 in project mode** | • Platform for data sharing by top mgt and periodic briefs for decision making<br>• Having or utilization of coordination mechanisms in country<br>• Clear HMIS strategy<br>• Linking the HMIS and M&E arms |
| **Poor stakeholder engagement lack of coordination and integration** | • Data governance policies and guidelines<br>• Enabling policy and legal framework<br>• Inclusion in the next 5 year Health Systems Strengthening (HSS) Plan<br>• Systematic review of tools<br>• Accountability |
| **Limited capacities, high attrition and poor attitude** | • In service training (for accreditation by health professional councils)<br>• Supportive supervision and mentorship and coaching<br>• Pre-service training<br>• Innovations to address the cost of training e.g e-learning |
| **Lack of conducive infrastructure and finances** | • Develop a strategic plan for HMIS based on equipment inventory<br>• Resource and partner mapping |
| **Restricted Donor Funding due to partner program interests** | • Establish Government coordination platforms and strategy<br>• Implement the HSS approach |

Infrastructure has been a challenge even for the most successful countries like Ghana which has large geographic areas with poor connectivity. Countries need to assess their infrastructure needs (equipment and connectivity) and find the means to finance and maintain it if they want to operate DHIS2 or any other digital health platform at national scale. This has largely come by including it into universal services provision funding allocations by Ministries of ICT. There has also been a challenge for countries such as Timor-Leste that had much earlier versions of DHIS2 to adopt and use the global packages as it required a system upgrade that was not easy for some countries to undertake without technical support. Some countries have been able to achieve national scale roll-out and high rates of health facilities reporting immunisation data into DHIS2 by successfully leveraging partnerships with funding agencies and putting into place local support structures.

## Global Survey Results

In March 2020, HealthEnabled conducted an on-line survey on DHIS2 and GIS for immunisation in English and French. Seventy-six (76) survey responses were received in total with 45 in English and 31 in French. Survey responses were from 30 countries, 20 from English-speaking and ten (10) from French-speaking countries. The majority (n=20) of the respondents were reporting for African countries. This is largely because the Gavi investment in DHIS2 in Africa was higher than in other regions, and it is also where some of the global packages were piloted. Respondents work for the national government Health Information System (HIS), government immunisation programmes, sub-regional governments, UN agencies, Non-Government Organization (NGO) partners, donors, and independents. Government respondents accounted for 51% (39 of 76) of respondents.

Respondents from all countries except one reported using DHIS2 for aggregate data collection and analysis for different health service delivery areas, including immunisation. More than half reported using DHIS2 for disease surveillance and immunisation supply and stock management. Only two respondents reported using DHIS2 for capturing individualized data alone (not in conjunction with aggregate data collection). In general, DHIS2 data collection happens at community, health facility, and sub-regional/district levels. Twenty-four (24) respondents reported DHIS2 data entry only happens at district or sub-regional government, while seven (7) respondents reported DHIS2 data entry only happens at the health facility level. Thirteen respondents from seven (7) countries report collecting individualised data, equivalent to using the DHIS2- tracker data model for individualised longitudinal data.

Respondents reported using a mix of many approaches to improve the quality of data collected using DHIS2. In the last two years before the survey, 18 countries received DHIS2 funding, and four countries were not sure if they received any DHIS2 funding. Ten of these countries received funding from three or more different organisations. DHIS2 support for countries were provided by UNICEF, University of Oslo (UiO), WHO, USAID, CDC, Global Fund, and Gavi. One country reported receiving funding from the Ministry of Health (MoH). The majority of DHIS2 assistance included capacity building components (59%) and configuring the immunisation dashboard (45%). Other assistance focused on DHIS2 upgrades, immunisation data migration, needs assessments, maintenance, and more. About half the respondents suggest the following

DHIS2 function improvements: campaign monitoring, supervision, better dashboard, coverage, tracker, accountability dashboard, use of master facility list, mapping cold chain equipment, tracking adverse reaction, and birth notification. More than half of respondents were familiar with WHO guideline "Analysis and use of Health facility data: Guidance for Immunisation Programme Manager".

Respondents in the comments section were interested in integrating DHIS2 with other digital data sources and more data analysis and visualisation at sub-national levels. Half of the respondents also provided recommendations for DHIS2 improvement in core functionality areas like data collection, aggregation, analysis, and visualization with the reflection that these features remain sub-optimal. A more detailed presentation of results is available upon request.

## Review of literature

A review of published literature, articles and project documents highlight the important elements for successful use of DHIS2, including integrated training, a culture of data-use, commitment from leadership and sustained resources. Many countries face the difficulty of data not being used for action and decision-making, especially at facility and district levels, a challenge that stems from a lack of data ownership, accountability at sub-national levels (Sahay, 2011; Usifoh et al., 2019). There are not many good examples of DHIS2 implementations with solid governance and culture of data use at sub-national levels. Even though DHIS2 can make routine immunisation data available, training for EPI staff and data managers is essential to build a positive sense of data ownership for improved decision-making at all levels (Sahay, 2011; Usifoh et al., 2019; Nisingizwe et al., 2014; Etamesor et al., 2018; Braa et al., 2012). Training programmes aimed at improving staff understanding of the utility of data have shown promising results for improving data use and data quality (Nisingizwe et al., 2014; Etamesor et al., 2018; Braa et al., 2012). Sustained funding and resources to provide training, refresher courses and to maintain skills in a workforce with high staff turn-over is needed to ensure that the skills and knowledge for data use in the workforce are maintained.

Country experiences as well as published studies show the potential for DHIS2 to improve data quality, timeliness and completeness but these improvements depend on staff training, data priorities and available time and resources to focus on data management (Kiberu et al., 2014; Manya & Nielson, 2016; Jamin et al 2014; Ward et al 2017). The transition from old data systems to DHIS2 creates an extra burden on data entry during the transition but also presents logistical and technical difficulties in importing historical data. Although this issue is improving, there is still a need to support the update of systems, data migration and the transition process. For systems that require data collection at the facility level or at point-of-service an increased data-entry burden is reported for frontline healthcare workers who must complete two or more parallel reporting systems (Adaletey, 2017; Clarke et al., 2019).

There are also reports of some countries with indicators that do not match those in the standard reporting packages and differences in data disaggregation dimensions as well as differences in dashboards. It is unclear whether this is the complete metadata packages or the denominator and indicator package. There is a natural tension between how the global packages support (or not) the country level HIS and reporting requirements and analyses and how countries HIS can be

adapted to better align with global packages. Experiences stress the need to understand the local facility-level workflow, data collection practices and training needs and to build the trust of the frontline health workers through sustainability, reliability and a system that reduces workload rather than increases data entry burdens (Adaletey, 2017; Clarke et al., 2019; Ngoma et al., 2012).

## Contextualizing Gavi's Support in the Broader Funding Landscape

Gavi, the Vaccine Alliance is one of several funders of DHIS2. The other four main funders - Norad, PEPFAR, Bill and Melinda Gates Foundation (BMGF) and Global Fund - were approached to share their own experiences and strategies for funding DHIS2 and to reflect on how Gavi's support compares, aligns, and/or disrupts overall funding for DHIS2. Although the three largest historical donors for DHIS2 are Norad, Global Fund, and PEPFAR; there is a sense that funding for DHIS2 is currently more evenly distributed among donors.

The current agreement between GAVI and UiO has a mix of general contributions to the DHIS2 platform maintenance and earmarked funds to global DHIS2 products dedicated to immunization data specifically. Global partners will continue to support DHIS2 maintenance support via pooled funding until a sustainability/business plan is set and countries are in a position to take over and able to contribute to the core cost of DHIS2 platform. It is planned to review the global sustainability plan for DHIS2 during the next year DHIS2 strategy preparation, and we will have by then a clearer idea of the timelines involved.

For information, currently, each of the partners organisation are committed to The Principles of Donor Alignment for Digital Health and to support DHIS2 as it is a Global goods (Scalable, sustainable, accessible, interoperable, and evidence-based digital health global goods that meet country priorities). The DHIS2 software platform and related global products such as implementation guidance and training material are co-funded by multiple global investors including Norad, GAVI, Global Fund, PEPFAR, CDC, UNICEF and BMGF. Some donors like Norad, USAID and BMGF are supporting a higher portion of maintenance cost than Gavi. In order to coordinate this pooled funding, UiO hosts an annual DHIS2 investor meeting and provides financial reporting through a shared donor reporting framework agreed by the investors. The annual financial report offers full transparency on the overall accounts and budgets showing who funds what; mitigating duplication and highlighting critical funding gaps to guide future investments. The pooled funding across investors enables UiO to secure long-term positions for its staff, offers security and long-term sustainability of the DHIS2 platform to the countries using the global public good, improves efficiency, and saves costs.

Gavi's direct support to UiO has been well received and has enabled immunisation to become more visible in DHIS2 annual meetings. This has advanced advocacy for immunisation programme needs and facilitated coordination with other donors. It has also enabled Gavi to have some influence over DHIS2 priorities and agenda setting. At the global level, the focus on creating global packages across all aspects of immunisation programming is holistic and complemented at the country level through HSS support for implementation of immunisation

packages. There is, however, a perception that Gavi places too much emphasis on DHIS2 for digital health investments and has a biased focus on the platform.

> *"There is a perception within and outside Gavi that DHIS2 is a preferred provider, but this is not the case. Gavi supports the national health information systems that the country prioritises and DHIS2 is one of a number of digital health tools and investments that the Alliance makes to support its work."* – Key informant

Gavi has never been prescriptive on what system a county should or should not use, but their support and investment for other digital health tools have not been as coordinated or as systematic as DHIS2. Within the countries Gavi supports, there is a strong country preference for DHIS2 in the absence of any other nationally scaled platform option. More due diligence is suggested to effectively communicate the pros and cons of DHIS2 alongside other digital health tools to help countries make informed decisions. It is recommended that Gavi explore similar systematic approaches to other digital health tools, especially eLMIS.

Gavi's push to support interested countries to move immunisation data into DHIS2 has been viewed overall as positive. "By moving immunisation data into DHIS2, Gavi took a strong position to support national data systems- a leap of faith," one key informant remarked. "This led to better data availability." Others argue that if Gavi had not done this, then immunisation programmes would have been left behind with a manual Excel-based parallel DVTMT reporting system.

At the regional level Gavi supported both WHO Afro and HISP to help provide support to countries that were trying to implement DHIS2 immunisation modules. There is good meaningful collaboration with WHO Afro as they are the focal point for immunisation at country level. EMRO and PAHO are looking at adopting a similar model. However, there is a need for more involvement and broader engagement and involvement across regions and subject matter experts in the development of global packages.

> *"At the country level donors face the challenge of navigating Ministries of Health that want to build everything in the health programme around DHIS2 rather than integrating other systems and platforms that can provide better functions in some areas."* – Key informant

A key common priority area for donors is well-functioning and supported HIS with effective data use, which are perceived to offer a major step up for countries despite their prioritisation of EMRs and other systems. Successful donor collaboration at the country level is often the result of good working relationships and coordination between the Gavi Senior Country Manager (SCM), M&E Focal Point and other donors supporting DHIS2 within a country. In some countries, the technical assistance plan for DHIS2 was jointly developed by partners. In other countries this coordination was lacking but has improved with Gavi requesting that TA be reflected in funding requests and workplans.

The following recommendations were made specific to global donor coordination that are relevant for Gavi's investments and UiO's stewardship and leadership of DHIS2:

- Set a vision for collective action for DHIS2

- Clarify roles of donors and UiO
- Support more country voices in shaping DHIS2 alongside the donor coordination
- Rally around upcoming donor collaboration efforts, including Master Facility Registries
- Ask better performance questions for increased accountability and quality assurance

One useful tool for consideration to help benchmark DHIS2's value – hypothesized to be relatively high – is the Software Global Goods Valuation Framework developed with support from USAID.

## Gavi Investment in DHIS2 SWOT Analysis

Throughout the review process, it was clear that Gavi wants to build on what is going well (strengths), address what is lacking to overcome challenges (weaknesses), to take the greatest possible advantage of chances for success (opportunities) and to minimise risks (threats). The following SWOT analysis provides a synthesis of reflections from the key informant interviews on Gavi's investments in DHIS2 for immunisation and a bridge towards where and how it might invest moving forward. It was highlighted that a key characteristic for countries that will either advance or hinder effective use of DHIS2 for immunisation programming is the presence or absence of a culture of data use supported through a data system structure to enable effective use of data. As reported by one key informant, the latest Health Data System Assessment shows that 4% of the 133 countries that participated can make the best out of their routine data system.

### Strengths

#### Platform

- Strong country buy-in and emerging country success stories
- Standard packages and approaches to immunisation across countries
- Supports increased data availability and completeness and facilitates a workflow of data into data warehouse and lakes for more robust analytics
- Enabled rapid engagement on Covid-19
- Can be engaged gradually and learned along the way, making adjustments as needed due to limited funding

#### Country introduction, rollout and maintenance

- Rapid local adaptation and engagements on Covid-19 modules show to local capacity
- Large global and regional community around development and implementation
- Generally good relationships between HISP groups and country governments

#### Funding and cooperation

- TA and support for national teams through-PEF TCA
- Strong relationship and coordination with WHO-AFRO and HISP through UiO
- HSS grants and complementary support to Global Fund grants

### Weaknesses

#### Development and support

- Not enough user-centred design with EPI programme representation across regions in development or global packages and workflow configuration
- Not enough testing and Q/A milestones to determine when global packages can be deployed more broadly
- Country demand for capacity building, implementation support, and technical assistance is higher than Gavi country funding to date

#### Country introduction, roll-out and maintenance

- Standard packages have been introduced into countries but not systematically used
- Not enough focus on data quality and use
- More advanced packages (case-based) adopted before basic packages (aggregate) are well established – need a maturity model approach

#### Funding and cooperation

- Lack of transparency in Gavi priority setting related to funding for DHIS2 global packages
- Low funding levels per country in Gavi HSS grants with little support for enabling environment

## Opportunities

### Platform

- Using the same platform across health programmes is cost saving and sustainable for countries
- Ability to link operational data from DHIS2 to IA 2030 data priorities and indicators
- Robust analytics to improve use of data in a way that improves immunisation programs and outcomes
- Move towards automation and pre-population of data to reduce data entry burden

### Funding and cooperation

- COVID-19 offers an opportunity to highlight the completeness of Gavi investment from disease surveillance to immunisation planning and monitoring to AEFI reporting
- Digital health donor coordination related to Covax - mapping where donors have specific investments and aligning efforts
- Collaboration with World Bank to use DHIS2 immunisation modules to support service delivery
- Shift in Gavi 5.0 to approach data as a programmatic activity and an opportunity to:
    - Identify and immunise zero dose
    - Support Master Facility Lists
    - Integrate stock data
    - Optimise service delivery
    - Support data quality as path to data use

## Threats

### Platform

- Lack of good interoperability and country buy-in to integrate DHIS2 with other global goods (OpenLMIS and OpenSRP, CommCare, iHRIS, etc.)
- DHIS2 is too IT/ HIS focused and not co-designed and configured with EPI Programme Managers to fit into their workflow to encourage more effective data use
- May be left behind as a reporting compliance tool rather than a useful decision-making tool

### Development and support

- Limited operational research or impact evaluation of Gavi investment in DHIS2
- Digital health expertise and public health expertise split across multiple partners and divisions within organisations making it challenging to coordinate effectively within the ecosystem

### Country introduction, roll-out and maintenance

- Belief that DHIS2 can and should do everything
- Belief that DHIS2 is complete and can just be implemented by countries with no support

### Funding and cooperation

- Gavi investment not focused enough on working with in country partners to support countries to adopt and use DHIS2 well
- Limited engagement and not enough people to support country implementation
- WHO data initiatives in general distributed across 3 divisions with implications for DHIS2

Some of the challenges expressed by key informants are going from global to country and then sub-national levels, translating from standard approaches to country realities. Key constraints include skilled people and time that is made more challenging by a lack of data use culture. There is also a perceived need for more ethnographic research to understand and update the software to address the pain points. UiO are actively working on striking a balance between central and distributed coordination of country assistance efforts.

> *"UiO are victims of their own success and don't have the capacity to meet demands. This is stressing people out at all levels- at UiO, within partners, and at country-level. There is no time for needed follow up, documentation, evaluation, and user feedback."* – Key informant

There's a natural desire for countries to want a "miracle" solution, one system that does everything, but this is not possible nor desirable. This speaks to a broader need for sensitization vis-à-vis digital architecture to support health programmes.

*"DHIS2 is well supported and well-liked. If not DHIS2, what is the alternative? What is fit for purpose? What is available? What better solution does the market provide?"* – Key informant

There is a perception that UiO wants DHIS2 to do everything needed by Ministries of Health including stock management, but there are other systems that they ought to integrate with for data collection rather than trying to replace them. At the same time, there are natural areas where they should be engaging like data visualization and analytics to make data more useful at district and sub-national levels for EPI Programme Managers where they are not. The work by WHO to establish a digital health clearinghouse of vetted solutions should help countries make informed decisions about what tools to prioritise for what and what gaps remain that might be well suited for new development.

*"This movement towards products over platforms goes against the "separation of concerns" approach of open-source software and undermines other Global Goods that are more mature and may have other functions that would benefit health service delivery and front-line health workers in a way that cannot be addressed by DHIS2 in the short or maybe even long-term."*
– Key informant

The regional support beginning with WHO Afro with local HISP coordinators has been good, especially prior to Covid-19, but this was temporarily shifted for the disease surveillance module development to WHO HQ because Afro was overwhelmed with Covid-19 support. With this shift there was a loss of visibility and connection to country level. There have also been some significant lessons learned from the development of the global packages, especially those related to Routine Immunisation, Adverse Events Following Immunisation (AEFI) and the Vaccine Preventable Disease Surveillance, and Covid-19 modules. They lend themselves as important case studies of the sort of processes and systems that need to be put in place and upheld to ensure that what is being developed is fit for purpose and undergoes the appropriate levels of due diligence and engagement across regions.

**Lessons from the Global Packages & Modules Development Processes**

*Key success factors include: Strong WHO leadership with the ability to serve as a bridge between technical contributors and reviewers and software developers working alongside business analysts to support design and requirements gathering and testers to validate the work of developers.*

In the development of the **Routine Immunisation** modules, WHO led the development and coordination process in collaboration with UNICEF, country stakeholders and others to gather requirements. They then served as the liaison with UiO and HISP. As the packages were developed and implemented, WHO regional office convened face-to-face meetings and webinars with EPI and HIS country representatives to ensure that the modules and indicators were well understood and could be adapted to fit into the country systems. In addition, WHO Data staff were trained and engage with countries to support implementation and needs updates for future development and/or modifications. Through this over 33 countries are now using the routine immunisation modules. One challenge that was encountered, but that has since been resolved was coordination and communication between HISP, WHO and UiO

related to country engagement and support. To respond to this challenge, a Google shared document has been created to identify which countries need what and which organization will be able to support those needs. This also helps the coordination with GF and all units in WHO.

For the **AEFI Module**, there was a clear vision and strong technical leadership from a senior subject matter expert with technology experience from WHO to guide the process. From the outset the module built on the design of existing platforms (like Harmonia and VigiFlow) as complementary components of adverse events monitoring, experiences, and standards to create a reporting experience for EPI Managers that mimicked the systems and forms they were already using and then extending it to align with global reporting platforms and adding in analytics and visualisation for more effective use of data at district, national and global levels. The process included an incubation period to enable pilot countries to interact with the module to adapt it to their local context. A key advantage for this module is that is has been developed as part of the DHIS2 core, so any updates can be automated as part of overall system updates. A key recommendation is to build out the capability to prepopulate fields across immunisation modules to reduce the reporting burden and improve the user experience.

With the **Vaccine Preventable Disease (VPD) Module**, the process undertaken was similar with WHO leading the process on requirements gathering and serving as the liaison with UiO. However, several unanticipated challenges were encountered- including starting with a use case of meningitis due to the expertise of the WHO focal person. This has since been addressed by engaging a broader group of technical experts. The development process was divided into 2 Phases- the first to replace EPI Info, which is no longer supported by CDC, with the DHIS2 VPD Surveillance module; and the second to extend functionality follow the investigation process in real-time. The process encountered some additional challenges with WHO competing priorities with Covid-19 and technical partners not feeling that their inputs were not given full consideration.

**Covid-19 Vaccination Package** has also been developed using a similar approach and building on past experience and existing modules. On March 19, 2021 it was presented to country teams to introduce the indicators, data based, and how the data can be presented using DHIS2. There is also a coordinated approach for countries to request and receive support.

To address some of the challenges encountered in the develop of Global Packages, several partners suggested a more structured transparent process that includes:

- WHO gathering and agreeing requirements with technical partners and liaising with UiO. WHO vetting products with technical partners and pilot countries, consolidating feedback and coordinating updates and further testing with UiO.
- A clear development, testing and validation process for Minimum Viable Product (MVP) and for a product that can then be deployed and tested in countries representing different stages of DHIS2 maturity before it's pushed out globally.
- Engagement of additional technical focal people at WHO-Afro and other regional WHO offices.
- Embedding an immunisation specialist within UiO to serve as a bridge between technical working group members and software developers and DHIS2 specialists within technical partners like WHO, UNICEF, and CDC.

- Increasing the number of user experience specialists, designers and testers to work alongside WHO technical staff and UiO software developers.

In addition, the priorities highlighted by WHO-Afro include having regional instances of DHIS2 as a push mechanism for countries and for regular system data uploads. They also include increasing support from HISP and UiO for countries to implement all of the Global Packages- especially VPD surveillance and Covid-19.

## DHIS2 Look Forward

As part of its prioritisation of zero-dose children and immunisation completion as highlighted in the Gavi 5.0 Strategy, Gavi's work is transitioning to a greater focus on digital health information and the information systems and technologies that would enable countries to have the data they need to monitor operations and increasingly to directly support immunisation programmes to achieve immunisation outcomes. To support this shift, Gavi is moving its activities in digital health information out of the M&E portfolio into the Health Systems Strengthening portfolio. Within this expanded digital health information approach there is consideration for DHIS2 as one among a series of digital health tools and investments, including eLMIS. With that, there needs to be proactive consideration and comparative analyses of DHIS2 alongside and in conjunction with other digital health tools, especially Global Goods. There also needs to be clarity and clear communication related to how and when to extend DHIS2 and when and how to support interoperability, data triangulation and visualisation.

### Theory of Change

As part of this review and in support of the recommendations for improving the effective implementation and use of DHIS2 in the future, a Theory of Change framework was developed by HealthEnabled in collaboration with Gavi and UiO to illustrate the causal pathway from DHIS2 inputs to Immunisation Outputs and Outcomes, support critical thinking and guide coordinated investments for the road ahead.

| | | | | | |
|---|---|---|---|---|---|
| Health Impact | To save lives and protect people's health by increasing equitable and sustainable use of vaccines | | | | |
| Immunisation Impact | All children fully immunised in all districts and equitable coverage across population subgroups based on geographic, socio-economic and cultural differences | | | | |
| Outcome | Sustainably reach zero-dose children, under-immunised, and their communities with immunisation and PHC | | | | |
| Immunisation Outputs/ Outcomes | Support improved outbreak detection and response and connection back to routine immunisation | Increased capacity to identify, reach, monitor, measure and advocate for zero-dose children and their communities | Increased quality, timeliness, & delivery of immunisation services | Increased immunisation coverage and equity | Improved safety of vaccines |
| DHIS2 Outcomes Immunisation | Improved **disease surveillance** through better tracking & reporting of VPDs and new outbreaks | Improved **identification & immunisation of under-immunised children** through improved denominators/ targets, tracking of children & immunisation reminders to defaulters | Improved **service delivery and real-time monitoring** through better planning, monitoring, coverage tracking, stock visibility; & supportive supervision | Reduced **service and equity gap** through increased triangulation and use of sub-national data to plan and monitor immunisation | Improved capture, reporting, response, and mitigation of **vaccine-related adverse events** |
| DHIS2 Outputs (data availability, quality and use) | Informed decision making to set targets, plan and advocate for resources, monitor performance and equity, optimise service delivery quality and efficiency, identify adjustment needs, and inform policies and strategies | | | | |
| | Data Quality App, Process, and Review Meetings | | | | |
| | Strong support systems and mechanisms for effective use of DHIS2 inputs to advance equitable immunisation through increased availability, accessibility, quality, completeness, timely and effective use of data (including training and user support for district and facility EPI managers) | | | | |
| DHIS2 Inputs (immunisation packages with regional and country support ) | DHIS2 aggregate, Surveillance dashboard, Case-based surveillance module | EPI e-Tracker/ Electronic Immunisation Registry, Alerts & Reminders, Birth Notification App; Sub-national population target triangulation | DHIS2 aggregate; Immunisation dashboard; Immunisation analysis app; stock visibility & eLMIS interoperability | Bottleneck analysis app; Smart dashboard to facilitate data triangulation and use of GIS data (linked to Master Facility List-mapping immunisation services and cold chain equipment) | DHIS2 adverse events following immunisation (AEFI) module |

The main bridge between the various DHIS2 inputs is effective data use. Drawing from the WHO SCORE Health Data Technical Package, effective data use is defined as "informed decision making to set targets, plan and advocate for resources, monitor performance and equity, optimise service delivery quality and efficiency, identify adjustment needs, and inform policies and strategies." This effective data use is supported by the global immunisation packages and relevant data systems and governance to enable DHIS2 when used effectively to improve disease surveillance, identification and immunisation of under-immunised children, service delivery and real-time monitoring, and tracking of/ response to vaccine-related adverse events while reducing the service and equity gap through the triangulation of data. These contribute to key immunisation outcomes and high-level impact of "all children immunised in all districts and equitable coverage across population sub-groups based on geographic, socio-economic, and cultural differences."

To support the effective use of DHIS2 for immunisation, a core set of foundations and enablers were identified. These include foundations such as master facility registries/ lists, geospatial data, training, and data quality systems alongside government leadership and commitment, change management, and interoperability with other systems.

## Key DHIS2 & Immunisation Foundations and Enablers

| | |
|---|---|
| DHIS2 & Immunisation Foundations | • Master facility registry/ list<br>• Geospatial data with health facility location, boundaries and catchment<br>• Up-to-date data standardised immunisation data and data collection tools with standard data elements, indicators, metadata, reporting forms aligned with WHO indicators<br>• Standard Operating Procedures (SOP) - data collection, quality assurance, reporting, analysis, interpretation, action<br>• Availability of tablets and computers at point of data entry and/or care<br>• Training and refresher training for health workers<br>• Training and reference materials<br>• Onsite support supervision<br>• Data quality systems and data review meetings |
| Enablers | • Government leadership and commitment<br>• Data governance strategy and policy, including data use, data quality and data sharing<br>• Responsible data policies and practices<br>• Dedicated human resources with appropriate capacity to support both technology and data use activities<br>• Change management and data use culture<br>• Interoperability with other systems- including birth registries, eLMIS, community case management systems, and electronic medical record systems<br>• Sustained funding<br>• ICT Infrastructure and connectivity |

## Alignment with DHI Strategy

The Gavi 5.0 Digital Health Information Prioritisation identifies six digital health information-related outcomes that can contribute to the achievement of all children immunised and the zero-dose agenda. and outbreak prevention. Within each of these, there are ways that DHIS2 if used effectively aligns with these priorities. The following table leverages the Theory of Change and shows how each of the DHIS2 and immunisation pathways can contribute to the Gavi 5.0 outcomes.

There is, however, a perception that DHIS2's ability to contribute to improved immunisation outcomes is premature. The focus should first be on using DHIS2 for performance monitoring and service optimisation and to support triangulation with outcome data from other sources such as immunisation coverage surveys. To move towards the effective use for immunisation outcomes, it is recommended to explore opportunities to conduct large-scale effectiveness studies of "successful" DHIS2 for immunisation implementations.

"It's a long shot to say DHIS2 can support zero dose." – Key informant

Constructive approaches to transitioning to the use of DHIS2 as part of programme planning have been led by UNICEF with the application of the Tanahashi model to identify coverage issues as part of a systematic immunisation bottleneck analysis and aligning DHIS2 with other sources of data as well as other systems like CRVS for birth notification. In addition, countries like Senegal, Togo, and Ghana among others have demonstrated that this transition is possible.

**DHIS2 & Immunisation aligned to Gavi Digital Health Information Priorities**

|  **Zero-dose and under-immunised children identified and reached** via *GIS, digital micro-plans, birth notification, satellite identification of settlements* |  **Empowered District Health Teams** through use of sub-national data facilitated by *integration of data sources* |  Efficient **immunisation campaigns** facilitated by *real-time planning and monitoring* |  Reduced stock-outs and **optimised vaccine and supply management** via *e-LMIS* |  **Lost to follow up and vaccine hesitancy reduced** with *mobile App, SMS* and *eventually EIR* |  **Timely detection of vaccine-preventable disease outbreaks** through *integrated surveillance systems* from case notification to lab investigation |
|---|---|---|---|---|---|
| Improved identification and immunisation of under-immunised children through improved denominators/ targets, tracking of children & reminders to defaulters | Reduced service and equity gap through increased triangulation and use of sub-national data to plan and monitor immunisation | Improved service delivery and real-time monitoring through better planning, monitoring, coverage tracking, stock visibility, and supportive supervision | Improved capture, reporting, response, and mitigation of vaccine-related adverse events | Improved disease surveillance through better tracking and reporting of VPDs and new outbreaks |
| EPI eTracker with Alerts and Reminders; Birth notification app; Sub-national population target triangulation | Bottleneck analysis app; Smart dashboard to facilitate data triangulation and use of GIS data with mapping of immunisation services and cold chain equipment – through Master Facility List | - DHIS2 Aggregate, Dashboard, and Analysis App; -Health Facility Stock visibility (TSS compliant for end level use) | DHIS2 adverse events following immunisation (AEFI) module - EIR/DHIS2 tracker with sms reminder when readiness assessment ok | DHIS2 Aggregate, Surveillance dashboard; Case-based surveillance module |
| Linkages to GIS investments for population estimation and mapping | Interoperability and alignment with other Master Facility Lists and service delivery tools used by health workers | Interoperability with eLMIS, iHRIS, and other HIS platforms and service delivery tools used by health workers | Interoperability with global AEFI reporting systems & linkage and alignment with social listening and demand generation priorities | Interoperability with global surveillance and WHO reporting systems |

## Recommendations

As Gavi continues to support country needs in coordination with other donors work and through its support to UiO, WHO-Afro, and HISP, the following reflections and recommendations have been identified through the literature review, global survey, country experience review and key informant interviews. They can help refine and augment prioritised investments.

Gavi should:

- Empower Senior Country Managers and Programme Officers within Gavi Secretariat to support country coordination and oversight of DHIS2 activities with support from partners in coordinating TA and country implementation.
- Ensure Subject Matter Experts within several immunisation domains are available to collaborate with UiO and HISP in the development and update of user-centered DHIS2 products.
- Invest in strengthening operational use of DHIS2 for immunisation by supporting interoperability with other systems for human resource tracking and distribution, master facility registry, and stock tracking- then focus on analytics by triangulating with other sources of data like MICS surveys to see how DHIS2 operational data maps to immunisation outcomes.
- Support countries to assess the maturity of the digital health ecosystem and develop digital health and data use strategies that can support the enablers for DHIS2 along with other digital health and data investments for immunisation.
- Support the development of an independent comparative analysis of DHIS2 and other Global Goods for key prioritised functions and digital health, interoperability and data activities within immunisation to better guide country informed decision-making.
- Invest in eLearning and/or blended learning at global, regional, country and especially sub-national level to increase at significant scale local capacity especially for data quality and data use for EPI and health managers at district level and below to more effectively configure DHIS2 (alert, dashboards, data quality dashboards and apps etc.) and use DHIS2 data.

*"A win for Gavi would be an in-depth conversation about digital health more broadly and to contextualise DHIS2 alongside other digital health tools and resources and apply learnings from DHIS2 to other digital health investments."* – Key informant

In addition, more targeted recommendations were made related to the development of DHIS2 immunisation modules, regional support, support to countries, and research priorities.

### DHIS2 Immunisation Package Development and Implementation

- Clarify DHIS2's scope, strengths and place within broader technology ecosystem and how it relates to other tools for data input (EMRs, eLMIS, GIS) and for data output, data analytics including private sector players.
- Conduct proper formative evaluation in pilot countries with documentation and updates before moving to next phase. Establish a systematic approach to solicit country feedback and review of standard packages to inform and improve updates.
- Establish an R&D team to support experimentation with integration of frontline health worker systems and/or triangulation with data from other data sources (like MICS and DHS) to bridge operations and outcomes instead of building out additional functionality to do the same thing.

- WHO, UNICEF and other technical partners should collaborate actively in the development, testing, and validation of global immunisation packages to integrate and find synergies with CRVS, RMNCH, and nutrition and other primary health care packages.

### Regional Support and Engagement

- Replicate the regional support model through WHO and UNICEF regional offices in other regions to both provide country support as well as feed country feedback and technical expertise into the development and refinement of global packages.
- Support WHO-Afro and other regional partners in more comprehensive engagement and involvement in supporting data quality and use efforts at the country level and in developing global standard packages.
- Support HISP with capacity building in programme and financial management as part of the transition from UiO in providing direct country support. This includes the development and implementation of standard practices and processes – including proper documentation and Quality Assurance.

### Support to Countries

- Leverage the investments of other donors and development partners in each country to better integrate Gavi investments alongside others and continue building on the strong coordination and collaboration with the Global Fund at the country level. The Health Data Collaborative (www.healthdatacollaborative.org) can be a good mechanism to harmonise and coordinate with country partners to jointly support a national integrated HIS and EPI.
- Support countries to make informed decisions about which packages to implement with support for effective use, training materials, capacity building and governance.
- Ensure that countries progress from data availability to data completeness to data quality and data use in Aggregate systems before moving to case-based data collection and use (eTracker informed by a readiness assessment).
- For countries that are using DHIS2 as the national health information system, encourage the use of immunisation global packages to standardise and facilitate reporting to WHO-UNICEF (as the minimum reporting requirements).
- Work with countries to develop a transition and/or sustainability plan for DHIS2 for immunisation as a joint effort between HIS and EPI managers with a stronger focus of TA activities on EPI managers. Pair HIS people with EPI to configure DHIS2 so it can align with more programmatic uses of data through dashboards, alerts, etc.
- Explore approaches to harmonise and leverage DHIS2 to reduce reporting burdens through automation and data integration to global level- with good accountability, governance, and safeguards to inform global policy.
- Support a culture of data use at the country level. Engage countries to implement user-centered design for the development of dashboards that will support district-level

decision-making driven by actions and decisions that they can control. Focus on different sets of users to help transition from data for operations to data for programme use.

- Support capacity for local TA provision and coordination, including the development and implantation of national and sub-national help desks.

*Where is DHIS2 the Rolls Royce of information systems? Where is it the Fiat? Where can it stand alone? Where is it one among a suite of tools?* -Key informant

### Research and evidence

- Support evaluation and the sharing of lessons learned. Countries that have successfully used DHIS2 Immunisation applications should document and share their experiences with other countries to improve their own performance. This can include key success stories on DHIS2 data usage.
- There is a need for more research on real-time monitoring and feedback as well as the potential contribution of DHIS2 to UHC and Global Health Security. Immunisation is a good entry point for research as it is a distributed service that can help generalise country capacity and needs and to help understand information and connectivity needs, data flows, and management uses.

**DHIS2 & Immunisation Research Agenda Priorities**

Throughout this review, the need for more robust and rigorous evaluation of the effectiveness for DHIS2 for immunisation arose. It was divided into two broad research agenda categories: 1) operational research and implementation science research and 2) impact evaluation.

**Operational or implementation science research focus areas:** One recommendation is to identify two countries or two states within the same country to explore effective use of DHIS2 for immunisation to answer some of these implementation research questions. There are some countries that already have a clear vision, commitment and capacity that can provide examples of how DHIS2 can be used to support sub-national DHIS2 use for programming (such as Ghana, Rwanda, Senegal, Bangladesh, Myanmar, and Laos). A starting point would be to consider how they are using immunisation data and for what purpose. Building on this some of the prioritised research questions include:

- What are key drivers for successful adoption and use of DHIS2 by EPI managers?
- Examples and keys to effective use of DHIS2 alongside and in combination with other sources of data like eLMIS? How does DHIS2 data compare with Demographic and Health Surveys (DHS) or MICS?
- How to increase data use and make data more appealing to EPI managers to use for planning and for monitoring not just reporting?
- What data is most useful for what and by whom to create efficiencies and better target data collection and use activities?
- What happens if you keep expanding the system? What lessons are there from other systems? How can DHIS2 function as middleware with links to frontline health worker tools and robust analytical tools?

- What makes DHIS2 work in some settings and not in others? What enables good implementation? What disrupts implementation?
- What is needed to make DHIS2 more interoperable and more secure?
- How can you use DHIS2 to measure effective data use?
- Independent quality assurance review of the DHIS2 platform and the individual packages.
- How can immunisation data be harmonised and better leveraged with other PHC services like MNCH for linking data related to pregnancy registration, birth notification, CRVS and patterns of health service performance and uptake of services?

**Evidence of effectiveness and evaluation focus areas:** There is not yet solid evidence or a common understanding that DHIS2 contributes to improved immunisation outcomes, although country success stories are pointing in this direction. The following evaluation questions should be prioritised to contribute to this evidence base:

- Does the effective use of DHIS2 improve immunisation coverage and equity? How does this compare with other global goods used for EPI or no or poor use of DHIS2?
- What is the pathway for effectiveness? What is the threshold for data quality and use needed for improved health outcomes? Does it lead to better decision-making? Does it lead to identification of hard-to-reach populations?
- How does DHIS2 impact health at national level? What business processes does it facilitate to realise this impact?
- Does the effective use of eTracker improve immunisation outcomes and/or reduce loss to follow up -especially in high-population density/ urban settings?

## Conclusion

As Gavi looks back on its investments in DHIS2 for immunisation, there have been significant achievements with the development and adoption of global immunisation packages. Countries are increasingly transitioning from parallel reporting systems for immunisation to DHIS2 (and as the National HMIS) and demonstrating increased availability and use of data. The global, regional, and country-level support and donor coordination model by Gavi for DHIS2 is well-received and can be used to inform other prioritised digital health investments. Alongside the achievements are lessons learned pointing to the need for more support for design, testing, and quality assurance. The DHIS2 and immunisation Theory of Change maps out the pathways from DHIS2 immunisation modules to effective data use to immunisation outcomes and can serve as a foundation for future development, implementation, and evaluation efforts. For Gavi's investments to be sustained and to continue to improve immunisation data availability and use, recommendations have been made to reinforce the role of the Secretariat in donor coordination globally and the role of the Senior Country Managers and Programme Officers at the country level with additional support from HIS advisors or technical staff. Additional recommendations include to increase the engagement of WHO-UNICEF SMEs with UiO, support interoperability of DHIS2 with other platforms, invest in readiness assessments, develop DHI solutions comparative analysis tool for immunisation, and expand eLearning and/or blended learning initiatives for scaling use of DHIS2 data- especially at the sub-national level. A robust independent large-scale effectiveness study of the effective use of DHIS2 on immunisation

outcomes is also highly recommended. It is the genuine hope that this Look Back and Forward on Gavi Investments into DHIS2 for Immunisation can inform the activities of all key stakeholders actively engaged in using the platform in a way that ensures that *no child will be left behind with immunisation*.

## Annex A: List of Key informants

| Organisation | Key informants |
|---|---|
| Gavi, the Vaccine Alliance | Carine Gachen<br>Gustavo Correa<br>Laura Craw<br>Riswana Soundardjee<br>Dirk Gehl<br>Antoinette Awaga<br>Alex de Jonquieres<br>Lee Hamilton |
| World Health Organisation | Hong Anh Chu<br>Alain Poy<br>Madhav Ram Balakrishnan |
| UNICEF | Remy Mwamba<br>Karin Kallandar<br>Maria Muniz |
| University of Oslo | Anne Asmyr Thorseng<br>Rebecca Potter |
| Norad | Austen Peter Davis |
| US Centers for Disease Control and Prevention | Benjamin Dahl<br>Louie Rosencrans<br>Ester Sikare<br>Oluwesagun (Joel) Adegoke |
| Bill and Melinda Gates Foundation | Tim Wood |
| PEPFAR US Department of State | Mark DeZalia |
| USAID | Merrick Schaefer |

# Bibliography of References


Adaletey, D.L. 2017. Leveraging on Cloud Technology for Reporting Maternal and Child Health Services at the Community Level in Ghana. Journal of Health Informatics in Africa. 4(2). [link]

Braa, J., Heywood, A. and Sahay, S. 2012. Improving quality and use of data through data-use workshops: Zanzibar, United Republic of Tanzania. Bulletin of the World Health Organization. (90) 379-384. [link]

Clarke, K.E., Chibawe, C.P., Essiet-Gibson, I., Mwansa, F.D., Jacenko, S., Rhee, C., Kwendakwape, M., Kashoka, A. and MacNeil, A. 2019. Strengths, pitfalls, and lessons learned in implementing electronic collection of childhood vaccination data in Zambia: The SmartCare experience. International journal of medical informatics. 129:146-153. [link]

Etamesor, S., Ottih, C., Salihu, I.N. and Okpani, A.I. 2018. Data for decision making: using a dashboard to strengthen routine immunisation in Nigeria. BMJ global health. *3*(5): e000807. [link]

Jamin, A.M., Mqoqi, N., Kaposhi, B. and Schopflocher, D. 2014. Strengthening health systems through improved reliability of health information: An evaluation of the expanded programme on immunisation data management in Eastern Cape, South Africa. Southern African Journal of Public Health. Sept 2014. [link]

Kiberu, V.M., Matovu, J.K., Makumbi, F., Kyozira, C., Mukooyo, E. and Wanyenze, R.K. 2014. Strengthening district-based health reporting through the district health management information software system: the Ugandan experience. BMC medical informatics and decision making. *14*(1): 40. [link]

Manya, A. and Nielsen, P. 2016. Reporting practices and data quality in health information systems in developing countries: an exploratory case study in Kenya. Journal of Health Informatics in Developing Countries. 10(1). [link]

Ngoma, C.A., Kimaro, H.C., Igira, F.T., Mukulu, J., Kaasbøll, J.J., Yona, A., Mkabara, N., Sarikoki, S., Sangu, I., Njau, C. and Mnaya, A. 2012. Challenges in implementing a computerized name-based information tracking System: Practical Experiences from Maternal Health Care. (Master's thesis). [link]

Nisingizwe, M.P., Iyer, H.S., Gashayija, M., Hirschhorn, L.R., Amoroso, C., Wilson, R., Rubyutsa, E., Gaju, E., Basinga, P., Muhire, A. and Binagwaho, A. 2014. Toward utilization of data for program management and evaluation: quality assessment of five years of health management information system data in Rwanda. Global health action. 7(1): 25829. [link]

Sahay, S., 2011. Assessment of the ability of the health management information system in India to use information for action. Master's thesis, The University of the Western Cape. [link]

Shuaib, F., Garba, A.B., Meribole, E., Obasi, S., Sule, A., Nnadi, C., Waziri, N.E., Bolu, O., Nguku, P.M., Ghiselli, M. and Adegoke, O.J. 2020. Implementing the routine immunisation data module and dashboard of DHIS2 in Nigeria, 2014–2019. BMJ global health. 5(7):e002203. [link]

Usifoh, N., Yak, T., Dooga, I., Dankoli, R., Ajumobi, O., Adefisoiye, A., Adegoke, O.J. and Network, A.F.E. 2019. Measles Data Reporting in the District Health Information System: A Case Study of Gombe State. Global Journal of Health Science. 11(11). [link]

Ward, K., Mugenyi, K., Benke, A., Luzze, H., Kyozira, C., Immaculate, A., Tanifum, P., Kisakye, A., Bloland, P. and MacNeil, A. 2017. Enhancing workforce capacity to improve vaccination data quality, Uganda. Emerging infectious diseases. 23(Suppl 1): S85. [link]