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Gavi Digital Health Information Strategy

Technical Brief Series

Sub-national multi-source data for immunisation programme decision-making



Executive summary

Sub-national and district-level immunisation programme managers have the local knowledge and understanding to improve immunisation coverage, identify missed settlements, target areas for action and optimise immunisation planning and service delivery to reach all children within their catchment area. Digital and electronic systems create opportunities to share and analyse relevant data to facilitate rapid decision-making and action. Gavi, the Vaccine Alliance, has identified district-level data for immunisation decision making as one of six priority areas for digital health information investment that will contribute to the successful achievement of Gavi's 5.0 strategic goals. This document examines the evidence, experiences and applications of digital tools to support sub-national decision-making including planning, data collection, processing, analysis, sharing and feedback. Drawing from literature, evidence, key informant interviews and Gavi's DHI prioritisation exercise, the following actions are recommended both for Gavi and the broader data ecosystem:

RECOMMENDATIONS

- Prioritise initiatives targeted at multi-source (e.g., NHMIS, GIS, Survey, Surveillance...) quality data reporting, triangulation, visualisation, and use at subnational levels.
- Prioritise data quality improvement through harmonisation and validation of accurate population estimates at subnational levels.
- Prioritise evaluation of supported multi-source data interventions to extract lessons to apply in other domains.
- Improve capacity for data-enabled and evidence-based decision-making such as the ability to monitor and analyse data completeness, accuracy, integrity, and timeliness to identify data process bottlenecks, communicate rapidly with different levels of the immunisation programme and present findings and needs to supervisors.

This Technical Brief provides a review of the state of evidence and experiences with sub-national data use for decision-making, identifies gaps and makes recommendations to inform the development of Gavi's Digital Health Information Strategy.

Background

Electronic systems for immunisation data entry, analysis and information sharing give sub-national teams the ability to identify and track down defaulters, find areas of low coverage for targeted resources and action, manage vaccine stock levels and have the confidence to take action based on up-to-date, accurate and useful information (Sullivan et al. 2020; PAHO, WHO Americas, and PATH 2019; Nabunnya 2020; Werner et al. 2019). When combined with training programmes to build a common understanding and culture of data-use with dedicated resources for supportive supervision, immunisation data made available to sub-national-level teams increase their sense of data ownership and responsibility (Etamesor et al. 2018; Braa, Heywood, and Sahay 2012). As an example, data-driven improvements in district-level programme operations contributed to increasing vaccination coverage rates in Pakistan's Sindh Province (Sullivan et al. 2020). Categories of healthcare data use for immunisation programmes have been identified by PAHO (PAHO, WHO Americas, and PATH 2019) and include campaign planning, campaign monitoring, commodity tracking, decision support, data quality improvement, supportive supervision, training, demand generation activities, and addressing adverse events following immunisation. This report categorises data use along these categories.

Sub-national Data Use as an Enabler of Gavi 5.0 Strategy

Gavi's 5.0 Strategic vision of "leaving no one behind with immunisation" is hinged on the global Immunisation Agenda 2030 (IA2030) ratified in the 73rd World Health Assembly (WHA) in 2020 (IA2030 Core Team 2020). The IA2030 aims to operationalise this vision through regional and national strategies, ownership, monitoring, and targeted strategic communications. Gavi's Digital Health Information Prioritisation identifies "District-level multi-source data for immunisation decision making" as one of six inter-related digital health information strategies that will contribute to the successful achievement of Gavi's 5.0 strategic goals. The overall aim of this report is to present a coherent mapping of how sub-national health stakeholders currently use data for decision-making using data value chain and quality frameworks.

The Gavi DHI Strategy aims to support the effective use of data at sub-national level to facilitate attainment of the four strategic goals of Gavi 5.0 through the following pathways.

Goal 1: Introduce and scale up vaccines

National governments regularly use vaccination, surveillance, and other data sources to expand the breadth of protection through routine immunisation and mitigate outbreaks of vaccine preventable diseases (VPDs). District level managers have the granular data needed to locate missed settlements and defaulters; this will be achieved with appropriate co-triangulation

of actionable data for multi-level decision-making (e.g., coverage, surveillance, stock, operational data, demand for data, etc.) and contribute to a better understanding of the state of service delivery for targeted action to improve programme performance and responsiveness.

Goal 2: Strengthen health systems to increase equity in immunisation

Strengthened health systems often have high demand for quality immunisation services and increased reach of zero-dose and missed communities. Integrated data systems that map supply-side and demand-side data increase visibility at district level is an important characteristic of a strengthened health system. Such integration will improve overall data use for immunisation service planning, delivery and monitoring. Investments in information systems can contribute to broader digital and data use efforts in support of health systems strengthening.

Goals 3: Improve sustainability of immunisation programmes

Improved country capacity to budget for and provide domestic financing alternatives for immunisation will sustain EPI programme performance through phases of transition from Gavi support. Immunisation related cost analyses are better conducted closer to where vaccines are needed and distributed to mitigate risks and ensure that investments in vaccines and other immunisation programme inputs are secured and sustained.

Goals 4: Ensure healthy markets for vaccines and related products

Healthy markets for vaccines, immunisation-related products, and vaccine innovation will drive equitable distribution and prevent outbreaks and epidemics. Integrated data management tools and infrastructure serve as the backbone to help identify market needs at a granular level. They also contribute to other digital health information investments and empower a base of human resources who are able to use, maintain and troubleshoot and sustain digital health technology operations and effective data use.

Data-driven decision making is at the centre of public health practice. Defining the scope for vaccination, prioritising vulnerable communities, detecting outbreaks, preventing epidemics, and optimising immunisation service delivery in a country all require data, often from different sources and types of stakeholders. Different stakeholders also have different needs for collected data points. Some need data to fulfil International Health Reporting (IHR) or National health information reporting, while other stakeholders use the data for planning or feedback at different health system levels.

Review of frameworks, literature and experiences

High-quality health data play essential roles in programme performance monitoring and financial support reporting (Chen et al. 2014). Vaccination coverage data, a key metric for measuring immunisation, is reported and published annually by WHO and UNICEF (Burton 2009). The source for a country’s immunisation coverage data varies and may originate with service delivery data or household survey data (Bloland and MacNeil 2019). A study of immunisation data from 45 countries has shown a consistent data disparity between household surveys and reported coverage rates (Murray et al. 2003). Despite years of progress, vaccination coverage data quality remains a challenge for many low- and middle-income countries (LMICs) (Bosch-Capblanch et al. 2009). A data audit of DPT-3 vaccine data in twenty-seven countries identified significant weaknesses in monitoring, including difficulty verifying administered doses (Ronveaux et al. 2005). Gavi, UNICEF, WHO, CDC, to name a few, continue to provide support for immunisation data improvement through frameworks and tools.

A leading framework from 2018 for conceptualising and measuring data use not only places health information as one of the six core functions of WHO’s Health Systems Framework but recognises that it is foundational for the other five core functions (Nutley and Li 2018). Measures of data quality have long been established, with completeness, accuracy, and timeliness being the most used of the 49 attributes of data quality (Chen et al. 2014). The WHO, through support from Gavi, published the Immunisation Data Quality Audits (DQA) procedures (Ronveaux et al. 2005) and the Immunisation Data Quality Self-assessment (DQS) tool (WHO 2005). Measure Evaluation, in collaboration with Gavi and other partners, published a “Data Quality Audit Tool” in 2008 (Measure Evaluation et al. 2008). Other frameworks and tools include WHO’s Service Availability

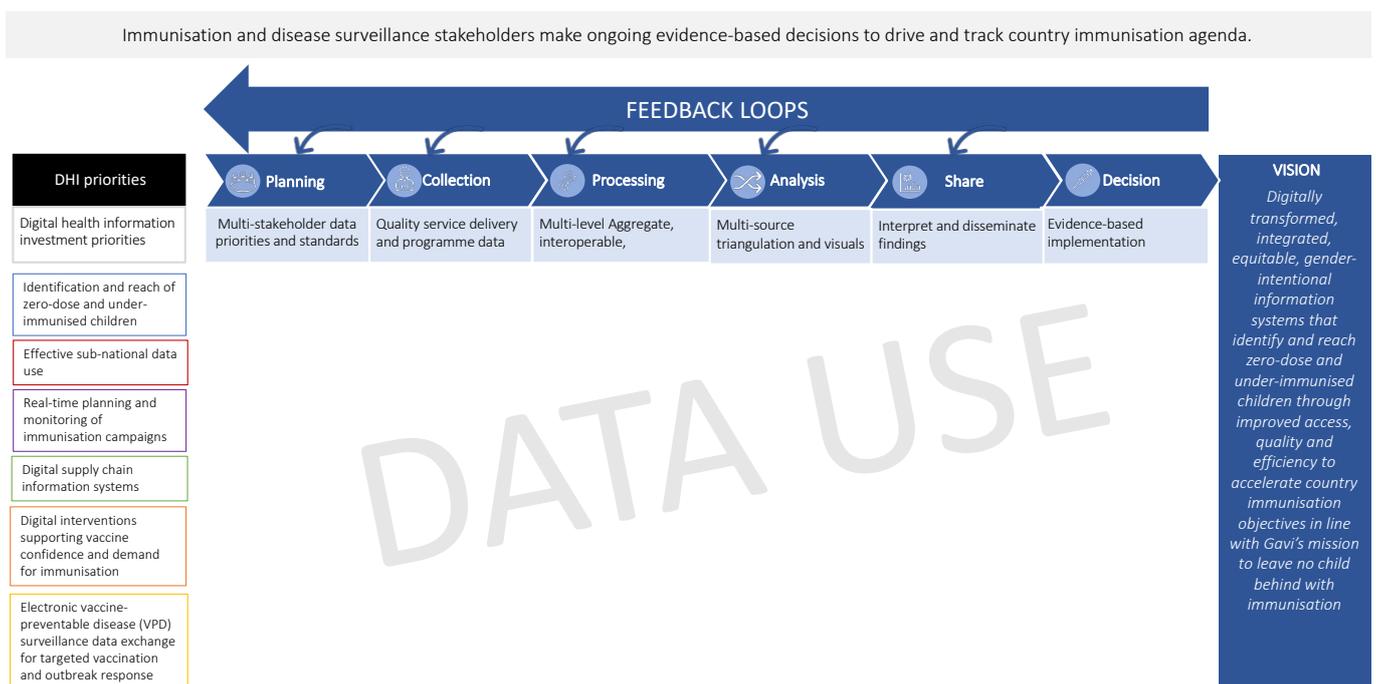
Readiness Assessment (SARA) (WHO 2013). At the health facility level, the Data Quality Report Card (DQRC)(WHO 2015) and Data Quality Reviews (DQR)(WHO et al. 2018) have been most commonly used.

Chen et al identified 11 attributes for defining data use thus: “trend in use, use of data or use of information, system use or usefulness of the system, intention to use, user satisfaction, information dissemination or dissemination of data, extent of data source recognition and use or specific uses of data, and existence and contents of formal information strategies and routines” (Chen et al. 2014). These attributes are further grouped into three broad categories – a) data use for action, planning, and research b) strategies and mechanisms for data use c) awareness of data sources and data use. Measure Evaluation published the “Conceptual and Measuring Data Use: A Review of Assessments and Tools” Framework (Nutley and Li 2018). The framework outlined data use stages to include: a) health information system improvement, b) health programme performance improvement, and c) improved functioning of the health system.

Data value chain

The evolution of data from creation to its impact is not often explicit or easy to trace. The connection between the different steps that change low-value inputs into high-value outputs can best be described as a value chain. The GSMA published a data value chain analysis report which categorises data into Generation, Collection, Analytics, and Exchange (GSMA 2018). “Finding the high-value uses and creating a process to transform raw data into actionable information is the essence

Figure 1: Gavi DHI priorities and the data value chain



of the data value chain” (Open Data Watch, n.d.). In a health system, data is captured, processed, analysed, interpreted, shared, or used for decision-making. Sometimes, these processes happen in sequence, and in other cases, they do not.

For improving health systems, data is used for vital statistics generation, information products, and meeting reporting obligations like the International Health Regulations (IHR) reports. When data is used for health system performance improvement, some tasks like review, interpretation, data-enabled advocacy, and other corrective actions are undertaken based on data. Data use for improved functioning of the health system will elicit actions like policy changes for improved health outcomes. The different data uses can be mapped to immunisation data value chain (adapted from existing frameworks) and digital health information priorities. Figure 1 depicts adaptation of data value chain from GSMA (GSMA 2018) and Open Data Watch (Open Data Watch, n.d.) and mapped to Gavi’s six Digital Health Information Priorities (DHI).

Impediments to data use

Different challenges emerge that limit data use at different stages in a data value chain. Financial, human and infrastructure resources remain major barriers to data production. This is often exacerbated by low data literacy, blind spots in data gaps, or limited desire for transparency by key stakeholders. On the other hand, lack of data relevance for decision-making and no rewards/results for data use equally discourage data use. Data is often not used at sub-national and facility levels because it is not perceived as useful, is collected for use at a higher level, or is presented in a form that makes it difficult to use. It is often difficult to reach a necessary consensus to determine the appropriate level of granularity and data sets to be collected and shared. Policy makers and implementers strive to answer the following questions: How can multi-stakeholder generated data remain interoperable and of high quality, while protecting individual privacy? How is offline-online access ensured? What is the perception of data value? Who demands generated data? What is the frequency of data feedback? How much influence in decision-making does available data have? Should data be shared in machine readable formats?

State of the Field

A review of scholarly literature to identify the evidence available on the current uses of data for immunisation and disease surveillance at health facility, sub-national and national levels were grouped by the adapted thematic areas from the IDEA project review. The IDEA report that identified what works in immunisation data is a recent review that found that only Electronic Immunisation Registry (EIR), Logistics Management information Systems and Dashboards had two or more strong or moderate pieces of quality evidence (PAHO, WHO Americas, and PATH 2019). The PAHO team also developed a data quality self-assessment tool for assessing immunisation registries (Danovaro-Holliday et al. 2019).

The BID initiative in Tanzania and Zambia identified limitations of “...DHIS2 and similar systems for person-level data” (Mvundura et al. 2019). The BID initiative worked with governments in Tanzania and Zambia to design and introduce an Electronic Immunisation Registry (EIR) at the sub-national level and gathered perceptions about adoption of EIR in these

settings (Dolan et al. 2020). The BID initiative also documented the cost for developing an immunisation registry (Mvundura et al. 2019).

In addition to the scholarly publications, prior reviews conducted on data use for immunisation (PAHO, WHO Americas, and PATH 2019), for demand generation and social listening for immunisation (Gavi et al. 2021) were also consulted. In addition, the current landscape of geospatial data and technologies, or GIS, for immunisation services was mapped in 2021 (Gavi, UNICEF, and HealthEnabled 2020) with three case studies describing experiences in Nigeria, Myanmar, and Cameroon. Eight potential uses of GIS for immunisation identified by the report are: 1) health system mapping, 2) population estimation/spatial distribution, 3) microplanning, 4) disease surveillance, 5) vaccine tracking, 6) campaign monitoring, 7) geographic accessibility modelling, and 8) vaccine coverage modelling.

Identification and Campaign Planning

Subnational health teams use health data for planning and in some cases intervention target identification. Health data is used at health facilities (Balakrishnan et al. 2016) and higher subnational level like districts or states (Bhattacharyya et al. 2020). Key informants indicated that district decision-makers use data from DHIS2-hosted National Health Management Information systems (NHMIS) for coverage mapping and campaign intensity facilitation. Similarly, microplanning is an emerging use of data at the subnational level, particularly GIS data in Nigeria (Dougherty et al. 2019), Chad (Ajiri et al. 2021), and Pakistan (Wesolowski et al. 2018). The GIS data can help in identification of missed communities, under-immunised and unvaccinated children.

“...GIS map is very helpful in terms of tracking settlements that are likely to be omitted or not planned for...” – Key informant

Mobile phone supported micro-planning has been introduced in Kenya (Ismail et al. 2017) and Chad (Atagbaza et al. 2021), and according to an informant, is being planned for in Nigeria.

“...development of an app which is going to be piloted ...for us to have an interface in terms of how the service providers can optimise the use of GIS maps and not only for just mapping, but for accountability, mitigating the risk of data falsification...” – Key informant

Demographic and health survey data has also been used in Ethiopia (Melaku, Nigatu, and Mewosha 2020) and other countries for planning. Statistical modelling is an emerging use of data, for example, the model of measles cluster identification in Indonesia (Sulistyawati and Sumiana 2018).

Campaign monitoring

Sources of country health team immunisation campaign data vary, though the majority come from the national DHIS2-NHMIS. A key informant noted that analysis of DHIS2 dashboard usage in Togo and Mali shows that “... the immunisation dashboards are among one of the top 5 or top 10 dashboards used in the system”. However, because of the configuration, it was difficult to determine the level of users accessing the system (health facility, district, or national). Other small scale sources of immunisation data include case-base

immunisation reporting system (Åijö et al. 2020), CommCare (Balakrishnan et al. 2016), custom EHR vaccine module (K. E. N. Clarke et al. 2019), VaxTrac EIR (Jalloh et al. 2020), a CommCare-ODK-FrontlineSMS system in Nepal (Style et al. 2017), an EIR in Zambia and Tanzania (Werner et al. 2019), an EIR in Peru and Mexico (Trumbo et al. 2018), a QR/Voucher and smart paper Gambia (Åijö et al. 2020; Sowe and Gariboldi 2020), and GIS campaign monitoring in hard to reach areas in Nigeria (Bawa et al. 2018).

Based on key informants, subnational health teams use NHMIS dashboards during campaigns for performance monitoring and course-correction. In regions where cold chain information is collected, these data can be used to determine where there are issues, for instance, “the number of days without the cold chain working”.

“...they use it often to look at and compare their performances, using the traffic light coding, which districts are in a red, green and so forth; they also look at the dropout rate, they also look at where there are issues with cold chain...” – Key informant

In addition, SMS reporting was highlighted as an important middle ground for monitoring campaigns more closely.

“...to use SMS to gather data, ... unlike the former paper where you have to wait for the end of the month to get reviews, now you have data coming in almost real time...” – Key informant

GIS data has also been used for monitoring household immunisation coverage (Kazi et al. 2017) and hard to reach areas (Bawa et al. 2018).

Data for eLMIS and Cold Chain

Key informants stress the importance of knowing how many vaccines or related supplies are delivered to district or health facilities. Information on the number of wasted vaccines and the functional status of refrigerators is also important. The availability of automated stock management at health facilities is viewed as the ideal state.

“...for example, the facility will wake up on the immunisation day and that’s when they realised one of the vaccines is out of stock....” – Key informant

Some countries such as Mali use the national DHIS2 NHMIS instance for managing stock data while others use a hybrid model. For example in Nigeria, the Vaccine Direct Delivery (VDD) Stock tracking system is used and sometimes compared with NHMIS data (Sato et al. 2021). Other kinds of data collected at pilot or small scale are Remote Temperature Monitoring, for example in Kenya (Lutukai et al. 2019). While the value of Remote Temperature Monitoring is clear, its current exact use is not well documented.

Decision support

Key informants recognise regular sub-national monthly (or quarterly) meetings where NHMIS data is discussed as the main scenario where data is used to influence decision-making and course-correction. PATH’s BID Initiative designed and piloted an EIR and made tools available to strengthen data for

decision-making in Tanzania and Zambia (Werner et al. 2019). According to key informants, though facilities and districts have some evidence of active use of immunisation data at the sub-national level, decision-making remains inadequately documented. A GPS-enabled vaccine tracking system was noted to aid better decision-making and accountability.

“... charts on coverage, temperature charts and of course their registers, in terms of the child registers that captures the routine vaccination, and then others that monitor the different doses that are given out...” – Key informant

Data quality assessment and improvement

Data quality remains a significant issue and contributes to the under-use of immunisation data with evidence of these issues from Nigeria (Akerle et al. 2020), Ethiopia (Endriyas et al. 2019) and Uganda (Nsubuga et al. 2018). Key informants identified wide variation in population-based estimation (numerators and denominators) as a leading cause of these quality issues.

“...in many countries, the EPI team may have some issues with the official denominators because when they use them, they end up having some coverage like above 120, and so on. So sometimes, they may come up with their own estimates for the target catchment areas of their districts...” – Key informant

Reliable and accurate denominator data is key to properly address coverage issues. Maina et al. assessed data quality and determined adjustment factors to improve population-based numerator and denominator for estimation in Kenya (Maina et al. 2017). NHMIS data completeness and timeliness are low hanging fruit with regards to data quality improvement. The case for deployments of EIR are often justified using expected data quality gains. Other important issues highlighted by an informant were “...falsification of data, and incompleteness...”.

“...when WHO Afro convened in Kigalicountries talked about district level data quality routine mechanisms. They were using the data quality app, then dashboards and then had these monthly routine feedback mechanisms to start improving the data quality.” – Key informant

Supervision, Mentoring, and Feedback

Technology can help facilitate supervision, mentoring, and positive feedback interactions that have been shown to impact health worker productivity and motivation. An ODK-based supportive supervision system has been widely used in Nepal (Style et al. 2017) along with polio dashboards in the Africa Region (Ticha et al. 2020; Clarke et al. 2019; Umar et al. 2021). The impact of feedback on community practitioners using CommCare was explored in an Indian district (Kaphle, Matheke-Fischer, and Lesh 2016). Key informants identify the quarterly review meetings as areas where performance review happens based on DHIS2 data and relevant feedback shared with healthcare providers. Better involvement of decision-makers was highlighted by informants as necessary to increase data-driven decision making.

Peer learning, networking, and training

There is little evidence in support of peer learning from our literature review except for a peer training of health workers in Nigeria (Okoronkwo et al. 2021). However, the benefits of peer learning were well articulated by a key informant.

“I was attending the EPI review meeting in one of the districts, and I was really pleased to see how the EPI focal points in health facilities in that district are coming with their own data to discuss it, and although all the discussion is actually based on data, I was really pleased to see that.” – Key informant

Demand generation and vaccine hesitancy

Key informants had little to say on the use of data to address vaccine hesitancy and improve demand generation. However, our literature review points to the increasing use of mobile for appointment reminders and demand generation in North-West Ethiopia (Mekonnen et al. 2019), immunisation messaging in India (Chakraborty et al. 2021), and reducing resistance and vaccine hesitancy to polio in Kaduna Nigeria (Birukila et al. 2017). The use of digital social listening across a broad range of data sources is increasingly being used to identify root causes of vaccine hesitancy and design strategies and programmes to increase vaccine confidence (Gavi et al. 2021). However, it is unclear how best to feed this data into sub-national health information systems to improve immunisation planning, service delivery and monitoring.

Adverse events

Data on adverse events following immunisation (AEFI) help facilitate an understanding of the prevalence of vaccine side effects. A review of operation centre data of adverse events was conducted following a measles vaccination campaign in Nigeria (Gbenewei et al. 2021). According to key informants, data is reported on a monthly basis in some instances and weekly in others. There were no examples for how this data is used at the sub-national level to inform demand generation activities, despite the perceived utility in doing so.

Aggregate surveillance

Most cases of disease surveillance from our literature were used for polio AFP detection using ODK in multiple African countries (Ticha et al. 2020; VanderEnde et al. 2020). A parallel complementary Technology Assessment has been conducted on the topic of disease surveillance.

“They also use the surveillance data to assess the risk of outbreaks, what responses are required and many others.” – Key informant

Reporting and multi-source data triangulation

There is consensus among key informants that most countries rely on DHIS2 to fulfil immunisation aggregate reporting needs. Similarly, many other digital tools were highlighted for reporting and for other uses like logistics management. In Sierra Leone, VaxTrac EIR is piloted for health facility data capture (Jalloh et al. 2020). An EHR system in Zambia includes an immunisation

module (Clarke et al. 2019). Individual-level immunisation reporting using detachable booklets has been piloted in Uganda (Åijö et al. 2020). Other examples include using CommCare in Bihar India (Balakrishnan et al. 2016), malaria case-based reporting and surveillance in Greater Mekong Myanmar (Oo et al. 2021), multiple case-based data collection systems in Nepal (Style et al. 2017), and SMS reporting in Nassarawa Nigeria (Akerle et al. 2021). Also, data from multi-year surveys are available in many countries, especially for population estimation.

On data integration, our research found ample published evidence of application-to-application interfaces. Examples include the multi-source FrontlineSMS, ODK, and CommCare system in Nepal (Style et al. 2017) and cross border collaboration surveillance between Kenya and Somalia (Arale et al. 2019). However, most key informants cannot point to actual integration in countries with different systems. All key informants are aware of ongoing initiatives in many domains in support of multi-source data integration in their domains.

“...what you probably have is, even if you report by ODK, somebody at the LGA needs to aggregate this data and feed into DHIS... I encourage that to be done, that also reduces human error in trying to impute data from one system to another...” – Key informant

Enablers for Effective Data Use

Key enablers for effective use of data are: 1) availability and use of wide range of capacity in information systems design, implementation, maintenance, and integration; 2) foundational registries – like Master Facility Lists, CRVS, and Master Patient Indexes; 3) information systems and data governance; 4) change management; 5) sustainable funding; 6) collaboration; 7) systems and data standardisation; and 8) infrastructure. Inadequate coordination remains a problem even when policies and strategies exist, as outlined by an informant.

“So far as we have the health information systems policy and we have a digital health strategy, it’s very important that partners do not deviate and have divergent interests against what government wants to drive, I think that is where we have problems...” – Key informant

Informants believe that as long as national stakeholders have a strategic direction, the subnational stakeholders will align.

“So far as the state realises that the interest at the national level is not fragmented, from my experience, the state will always align.” – Key informant

Finance for basic activities like attending quarterly performance review meetings can also be a challenge.

Capacity building was the most frequently highlighted enabler needed for this priority area. Capacity to use or interpret data at district level remains an important challenge. If available, it can be a key enabler.

“...we went as far as teaching the ward focal persons, the team members how to read maps, because when we were doing the settlement data validation, we needed to put a name on a paper to a place on the map, using what they knew as point of interest like a mosque, a church, the direction to know where a settlement...” – Key informant

In other cases, the capacity to configure DHIS2 dashboards, often supported at the central but not at the sub-national levels, limits the use of the dashboards to national governments.

Governance is also an important enabler to help districts ascertain how best to breakdown roles for data use.

“I strongly recommend that Gavi focuses on policy makers as part of the earlier action based on the strategy, advocacy to the health sector leadership is very key...” – Key informant

Infrastructure like electricity, connectivity, and hardware devices remain important enablers for digitisation in general and effective data use in particular.

“...you find facilities are not ready to have mobile phones and computers, there’s no secure place to store them, charging facilities and others.” – Key informant

Key Considerations & Recommendations

Recommendations for Prioritised Gavi DHI Strategy Investment

Global

- Facilitate the development of a comprehensive immunisation data toolkit to aid data-driven decision making with a focus on promotion of standard indicators, systems integration, data triangulation, data quality, and data use.
- Investment in evaluation and validation of supported interventions should be prioritised as this will be invaluable for scale.
- Support and document case studies that advance the use of multi-source data, beginning with coverage and equity, VPD surveillance, and stock management and expanding to demand data and AEFI.

Country

- Availability of a single view of immunisation, surveillance, laboratory, survey, demand and other information sources triangulated together will improve data value to multiple stakeholders and influence decision making.
- Support for harmonisation and validation of accurate population estimates at sub-national level remain crucial for effective data use, and support for such efforts will improve data use.
- Capacity building for different roles – data capture, data interpretation, data use, data communication, and solutions support will enhance data use. Specifically, capacity to configure and use dashboards at subnational levels will greatly improve data use.
- Support for country information systems and data maturity assessment and prioritisation and support for key enabler.

Conclusion

This assessment helps highlight the gaps in the digital and data for immunisation data value chain. Data from routine service delivery repositories (aka NHMIS) and available dashboards are used the most for campaign planning and health-provider feedback, especially during district data review meetings. GIS is also increasingly being used for settlement identification and campaign planning. Adverse event reporting has been used for post-campaign review, but not as much for decision-making and planning. There are also a few pilots of longitudinal patient information tracking systems. Despite their immense potential, they are limited in coverage with low capacity for use or support. Deficiencies in the enabling environment limits data

use from promising longitudinal sources. There are also limited examples and evidence to show the potential and/or impact of multi-source data triangulation or use at subnational levels. Limited integration of DHI systems both at national and district levels was significantly highlighted by key informants as limiting data use.

“Gavi should come up with a very good tool kit; in terms of data, what indicators should be captured at national level, district level and at facility level. How should the indicators be captured because it helps countries to just utilise ..and contextualise.” – Key informant

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Appendix A: Literature Review methodology details

A rapid review of published studies, research, project guidance and grey literature was conducted to better understand the context, current approaches and experiences with digital health and data applications used by country stakeholders for national and sub-national decision-making and data use.

Documents were identified for review from a broad semi-systematic database search using standard key words (see boxed text). Priority digital tools were selected for inclusion in the search terms based on their use for immunisation and frequency in the recent Digital Square Map and Match of Digital Solutions for Immunisation (Digital Square 2021).

From an initial 777 unique citations identified, 72 documents were identified for full-text review and included in the review. The documents selected for full-text review are a combination of publications covering planning and identification, reporting requirements, campaign activity tracking and monitoring, cold chain management, quality improvement, decision support, supervision and data triangulation. The scholarly search strategy was supplemented by consulting important reviews and grey literature relevant for each component of data use.

Literature Review Methodology

PubMed, Cochrane and Clinical Trials databases were searched for relevant literature since 2016 using combinations of the following keywords:

Immunisation/immunization
vaccine
campaign
data
data quality
DHIS2
SORMAS
AVADAR
arcGIS
GIS
Mobile Baby
ODK
True Cover
Kobo
Ona
Simprints
CommCare

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