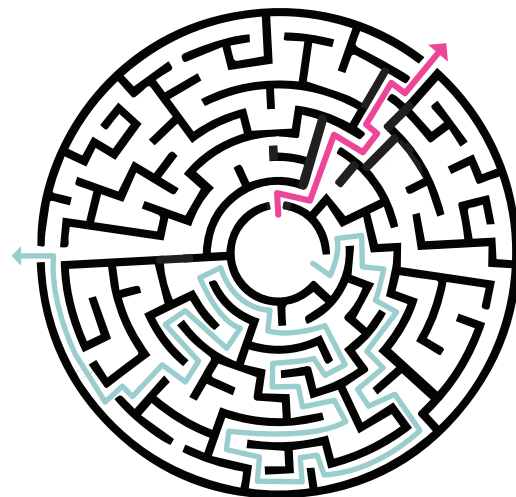


BETTER DATA FOR STRONGER HEALTH SYSTEMS

PART II: HARNESSING THE POWER OF DATA AND ADDRESSING FRAGMENTATION OF INFORMATION SYSTEMS FOR INFORMED DECISION MAKING



INTRODUCTION

A strong health management information system (HMIS) is the foundation of a strong health system, and the availability and use of high-quality and timely data is crucial for good governance and leadership within a health system. A well-functioning HMIS has the potential to empower policy makers, health managers, and other key stakeholders to make informed decisions across different functions of a health system, enabling them to more effectively address the health needs and preferences of the population. Better data facilitates the consumer journey through complex health systems and informs more effective resource allocation and policy making, which in turn can enhance the quality and utilization of health services and improve health outcomes. Furthermore, it can enable more effective disease surveillance and support better targeted interventions⁽¹⁾.

Despite advancements in technological solutions that have facilitated data collection and improved data analytics and visualization, health systems are not harnessing data to their full potential, and the effective use of data for health decision making continues to be limited in many settings (2,3).

One major barrier is data fragmentation within the health system. Health data is often stored in separate databases or information systems, each using different codes or names to refer to the same thing. This results in disconnected and isolated datasets, reflective of funding and programming silos, as well as a lack of integration across different levels of care. This fragmentation hinders a comprehensive

understanding of health service delivery and outcomes and makes it challenging to identify health system bottlenecks, ultimately reducing the effectiveness of health decision-making processes. Other key barriers to the effective use of data to inform health systems decisions include access to the right data, data quality, and skills in data use.

Addressing these limitations and challenges is therefore essential to fully harnessing the power of health information and making health systems more people-centered, efficient, and sustainable.

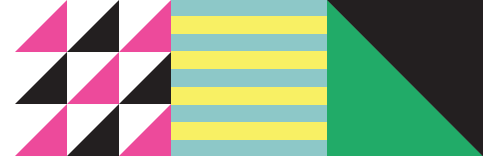
This technical brief provides an overview of some of the main barriers and challenges in addressing data use for informed health decisions, identified through a structured rapid review of the literature, with a particular focus on data fragmentation. It also presents promising solutions that seek to address these challenges and shares some lessons learned along with key insights from PSI's work.

KEY CHALLENGES

ACCESS TO ACTIONABLE AND RELEVANT DATA

To make well-informed policy or program management decisions, decision-makers need easy access to the right data. In many low- and middle-income countries (LMICs), access to actionable data is often hampered by the fragmentation of information and the limited availability of relevant data. Siloed data and absent reporting standards limit the interoperability¹

1. "Interoperability is the ability of different information technology systems, software applications, and networks to communicate, to exchange data accurately, effectively, and consistently and to use the information that has been exchanged" (27, pg. 1).



between information systems and the ability for health system managers to synthesize information across multiple data sources and fully understand issues at the programmatic level. Data that is accessible is not always tailored to meet the needs of decision-makers or presented in formats that are easily actionable. Consequently, health workers may spend a considerable amount of time collecting and reporting large amounts of data that are never used. This inefficiency can be avoided by identifying and prioritizing decision-makers' information needs in advance (3).

DATA QUALITY

Data quality is an important determinant of the success of data to decision-making processes and the utilization of HMIS by district-level health officials (4,5). Poor quality data negatively impacts decision making and can lead to the wrong conclusions, resulting in poor decisions in the short term, eroding trust in data quality, and impacting future demand for—and use of—data in decision-making processes.

Data quality and reliability can be compromised by various factors, including complicated reporting procedures, which can lead to operational inefficiencies, increase reporting burdens, and duplicate data collection efforts at both the facility and district levels. Furthermore, poor data standardization across systems, limited technology and infrastructure, and connectivity challenges may force a return to paper-based systems (3, pp 8). In addition to these challenges, many LMICs lack formalized processes for regular data quality assurance and review, as well as feedback mechanisms, which further exacerbates data quality issues.

SKILLS IN DATA USE

Data analysis, interpretation, and presentation skills are not always prioritized in LMIC health systems. Overall, there is an insufficient number of staff members who possess these skills coupled with a high turnover rate in the public sector, especially at the sub-national level (3). All these factors combined inhibit the use of data to its full potential to inform decisions. Previous studies have found that a limited

understanding of how data can be used (6), a limited capacity in research synthesis and translation (7), and inadequate staff training on data systems and lack of institutionalization of data utilization (8) inhibit data use and evidence-based decision-making. Another important factor to consider is the lack of recognition among data collectors regarding the use of data and how they contribute to the bigger picture. Fostering a culture of data use, even among frontline workers, could improve efficiency and resource allocation.

DATA SILOS

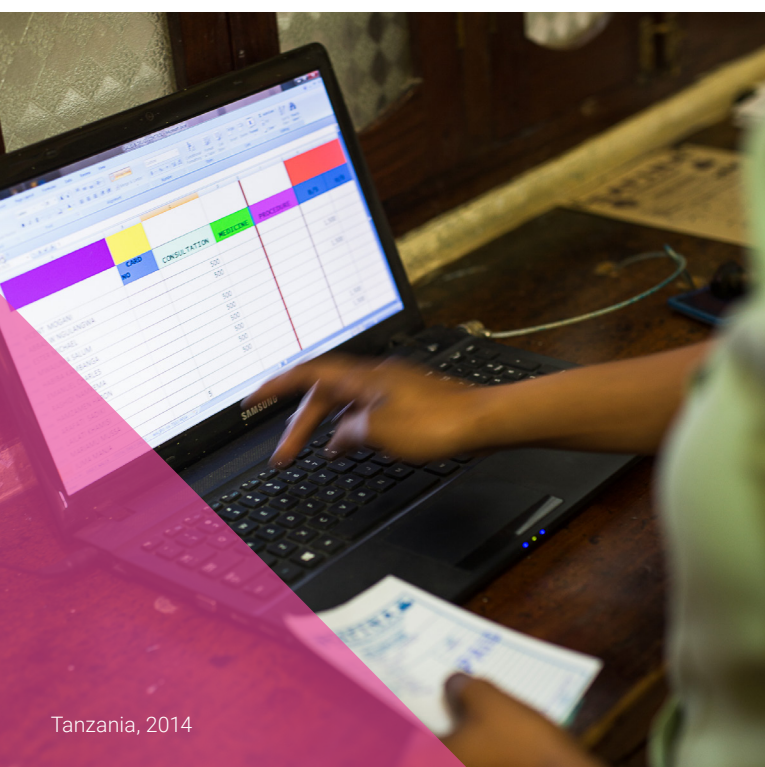
Data silos within the health system further complicate data management and utilization. Many countries have different disease-specific surveillance and monitoring platforms, usually in addition to a national HMIS and notifiable disease surveillance system. These parallel platforms typically come with their own procedures, data formats, and tools (9). This creates an extra burden for health workers, who need to navigate and manage multiple platforms. Fragmentation of information systems is common not only across health areas, but also across different layers and actors in the health system. These data silos mirror broader structural fragmentation within health systems, which occurs in the case of funding and programming silos but also is reflected in a lack of integration across different levels of care.

INTEROPERABILITY

Limited interoperability exacerbates these issues, hampering data sharing between healthcare providers and leading to inefficiencies in the system. Inadequate regulation and poor governance are key factors hindering interoperability. A recent study describing the interoperability landscape of Botswana's eRecord system noted that inadequate regulation and governance of electronic health records led to challenges in interoperability and data sharing (10). A lack of common guidelines and procedures can limit interoperability between datasets, making it difficult, if not impossible, to effectively use all the available data to inform decisions. This leads to suboptimal allocation of the limited resources, and ultimately to poorer health outcomes at a higher cost to the health system.

In many LMICs, patient information is not shared between healthcare providers as the patient navigates through the system. Providers often record patient information on different systems that do not communicate with one another. This lack of integration and interoperability complicates referrals, results in inefficiencies, and ultimately, affects patients' continuity of care (11). From the user perspective, this discontinuity can lead to delays, inappropriate treatment, and increased out-of-pocket expenses.

The proliferation of non-interoperable health information systems can therefore negatively affect the overall performance of a health system by introducing redundancy in data collection and entry and demanding additional time and effort from healthcare workers. Manual data transcription between different systems also introduces potential errors, leading to decreased data quality and reliability. All these issues therefore compromise the quality, timeliness, and availability of healthcare, potentially leading to adverse health outcomes (12).



Tanzania, 2014

KEY LEARNINGS AND PROMISING SOLUTIONS

PROMOTING GREATER HEALTH DATA INTEGRATION

Most governments are aware of the challenges to data use, and some have taken concrete steps to overcome them. Indonesia, for example, has launched a healthcare data integration platform called Satu Sehat as part of its digital transformation journey. This platform aims to build an innovative digital ecosystem in which electronic health records are interoperable so that patient data can easily be exchanged between health facilities. To integrate Satu Sehat into Indonesia's digital health transformation, the MOH released the electronic medical record (EMR) regulation, which mandates all health facilities to adopt an EMR, driving a digitalization of health service data at all levels of the health system (13). Under the Data Use Partnership (DUP), the government of Tanzania, supported by PATH, pioneered the Tanzania Health Enterprise Architecture (TZHEA), which aims to create a connected and interoperable health information system, facilitating seamless data exchange and utilization across the healthcare ecosystem (14). The government of India, through the National Institution for Transforming India (NITI Aayog), has set up the National Data Analytics platform (NDAP), which "aims to democratize access to public government data by making data accessible, interoperable, interactive, and available on a user-friendly platform" (15). It hosts datasets from different government agencies and offers tools for analytics and visualization with the ultimate goal of promoting larger access and better use of data while addressing issues of data silos. As of May 2022, the NDAP hosted 203 datasets from across 14 sectors and 46 Ministries (15).

ENHANCING CONTINUITY OF CARE THROUGH ONGOING ENGAGEMENT

Digital solutions have the potential to enhance continuity of care and improve referral systems. One such example is the PSI DHIS2-based Workforce

App (WFA), which supports community health workers (CHWs) and facility-based health providers to electronically register and track clients, support linkage to care through the issuance and redemption of electronic referrals via SMS, and facilitate real-

time, personalized performance management of the health workforce. In Myanmar, PSI has also developed a digital tuberculosis (TB) referral and follow-up system, utilizing a user-friendly chatbot and the DHIS2 platform (16) (see Box 1).

BOX 1

ENHANCING REFERRAL SYSTEMS AND CONTINUITY OF CARE

PSI DHIS2-BASED WORKFORCE APP (WFA)

The WFA is currently deployed in 12 countries globally. With more than 1.3 million clients registered and 832,000 electronic referrals made, the WFA can enhance continuity, quality, and efficiency of care across various health areas. [Click here](#) to access a short video that will walk you through an example of its application in Zimbabwe.

A DIGITAL ECOSYSTEM FOR COMMUNITY-DRIVEN INTEGRATED TUBERCULOSIS SCREENING AND TESTING SERVICE DELIVERY

PSI Myanmar and Sun Community Health, one of PSI's independent network members, have developed a digital TB referral and follow-up system. This system integrates a user-friendly chatbot on the Viber messaging platform with the powers of DHIS2. Community pharmacies conduct screenings of potential TB patients and share referral data through the chatbot with designated community mobilizers, who utilize a DHIS2 tracker mobile app. Patient information is then securely shared with health workers, enabling them to directly engage with patients for testing and treatment. Real-time monitoring dashboards in DHIS2 and PowerBI offer program managers performance metrics and strategic insights. The reach of these digital tools is significant: as of December 2022, 268 pharmacies referred 1,630 potential TB cases, 99 percent of whom were contacted by mobilizers. Among these cases, 32 percent tested positive for TB and received treatment. This digital ecosystem, initially developed for malaria, has the potential to be further expanded to other health areas, broadening its impact and relevance. [Click here](#) to learn more about this intervention.

ADOPTING A COMMON STANDARD RATHER THAN DEVELOPING A COMMON SYSTEM

WHO's recent endorsement of the Fast Healthcare Interoperability Resources (FHIR) standard, as part of its SMART² Guidelines, can be a real game changer when it comes to addressing fragmented information systems. The FHIR standard describes how to collect, store, use, exchange, and distribute patient and health data regardless of the application used. FHIR has been endorsed by WHO, the Africa CDC, governments of the US, UK, EU, India and New

Zealand, global technology companies, and multiple open-source health information systems (OpenMRS, iHRIS, OpenSRP). Organizations like PSI contribute to this movement by investing in a more comprehensive approach with focus on interoperability at scale.

The two examples provided in Box 2 not only address the challenge of data fragmentation but also pave the way for interoperability between different health information systems.

2. Standards-based, Machine Readable, Adaptive, Requirements-based, Testable.



ADDRESSING DATA FRAGMENTATION AND PROMOTING INTEROPERABILITY

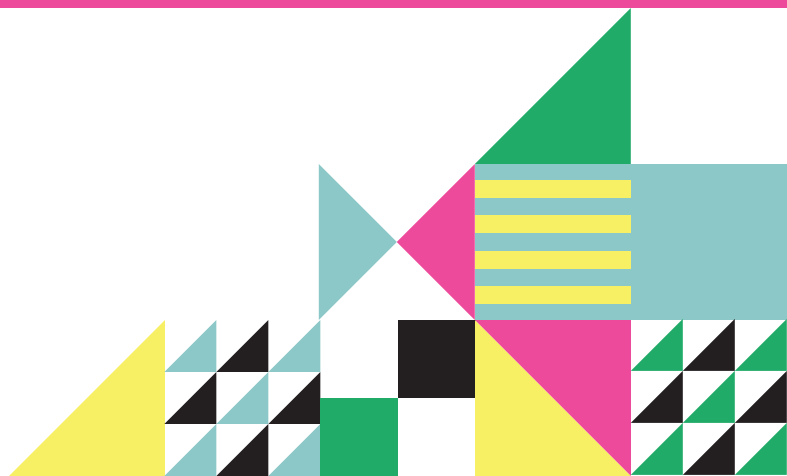
ENHANCING HEALTH INFORMATION SYSTEMS WITH BAHMNI EMR IN ZIMBABWE

In Zimbabwe with funding from a Maverick Collective donor, PSI and Population Solutions for Health (PSH) piloted an electronic medical records (EMR) system – known as Bahmi – for community-level antiretroviral therapy (ART) refills at 7 MoH facilities in Makoni District. The system was subsequently rolled out to PSI and PSH’s New Start Center network of excellence in eight additional facilities serving 15 districts in Zimbabwe. Its scope was expanded to also include a full range of HIV and sexual and reproductive health services. As of September 2023, the system has served over 350,000 clients. Bahmni works with a decentralized EMR server at each clinic with an offline Progressive Web App community-based module. Bahmni’s decentralized architecture, selective synchronization strategy, and integration with DHIS2 have streamlined data management, enhanced clinical decision support, and facilitated routine reporting, leading to improved patient outcomes and more efficient healthcare delivery. With Bahmni’s data integration on the Ministry of Health and Child Care (MoHCC) hosted servers, PSI and PSH are working with the MoHCC to decommission paper registers at all Bahmni supported sites. The implementation of Bahmni in Zimbabwe not only addresses the challenge of data fragmentation but also paves the way for interoperability between different health information systems. The Bahmni EMR ecosystem combines various open-source products, such as OpenMRS, Odoo, DCM4Chee, and OpenELis, into a single solution. This interoperability allows for seamless data synchronization using unique identifier codes. It also enables efficient referrals, clinical decision support, and routine reporting. Moreover, Bahmni’s compatibility with FHIR and its open-source nature provide opportunities for future integration with other EMRs and digital health systems and could be further expanded to additional health areas.

JALI – THE NATIONAL CONSUMER HEALTH CHATBOT IN KENYA

PSI and the Ministry of Health (MoH) in Kenya have collaboratively launched Jali, the national health line WhatsApp chatbot. Jali’s primary goal is to provide health information and facilitate linkages to healthcare facilities. Currently, Jali offers information on a wide range of health topics, including mental health, breast cancer, and immunization for both adults and children, among others. The Jali infrastructure has been set up within the MoH data center using the FHIR standard, which provides a robust and flexible common data model and REST* architecture that enables different health systems to share and integrate data, fostering seamless data sharing and integration among various healthcare systems and other FHIR implementations. PSI and MoH share a vision of creating a comprehensive one-stop shop for all consumer health needs. The full stack that Jali is built on is also open source making it cost-effective and sustainable for the government.

*REST: Representational State Transfer, a platform and language-independent architecture style for data communication using HTTP (web) protocol.





PROMOTING EFFECTIVE DATA UTILIZATION

ENGAGING DECISION MAKERS AND ADOPTING A USER-CENTERED DESIGN APPROACH

Data integration should begin with engaging decision makers and understanding their needs and preferences for how they will use data and how it can best be presented. This engagement is key to gauge actionability of selected indicators to ensure they are “fit for purpose” and “fit for use”³ (17). A user-centered design approach to data dashboard production can help translate and distill data from

HMIS into actionable information. Co-designing dashboards and visuals with the end-users – in this case, the decision makers – allows developers to tailor the data presentation to the needs and preferences of decision makers (see Box 3). This tailoring ensures that the data is meaningful and useful to decision makers, enhancing their ability to effectively use it. This approach also helps clarify what data is needed and prioritize data reporting requirements accordingly.

BOX 3

THE POWER OF DATA-TO-ACTION (D2A) FRAMEWORKS

To better understand what data is most needed by decision-makers, PSI utilizes Data-to-Action (D2A) frameworks to work backward from national program requirements. This approach helps identify the decisions that different stakeholders at various levels need to make and the corresponding data required to inform those decisions. Many programs are inclined to collect a large number of data points on the assumption that more data is more useful; however, data that is collected and not used creates an unnecessary burden for health providers and other actors.

The D2A frameworks also allow PSI to design appropriate data visualizations and thresholds to further support decision-makers. These frameworks strike the right balance between imposing a manageable reporting burden on providers and ensuring that decision makers have the data they need. With support from the University of Oslo, PSI has also built an interpretation function within DHIS2 to make D2A frameworks available directly in the DHIS2 Analytics interface. This makes it easier for policy makers to review and interpret the data and proceed accordingly. The D2A approach has now gained recognition and support from governments in several countries where PSI operates. For example, in Puntland, PSI works with the MOH’s immunization program to identify the 5 things that are critical to them. PSI then works with the HMIS team to design a dashboard that responds to the immunization program’s specific needs.

FOSTERING A CULTURE OF DATA DEMAND AND UTILIZATION

Training alone is not sufficient to ensure the performance of a health information system, and successful data use for decision-making might require additional supportive components, including regular stakeholder meetings and mentorship (18). This aligns with a need to shift toward building organizational capacity rather than solely focusing on individual capacity development. This transition includes elements like mentorship and job aids, in addition to other training activities (19).

The MEASURE Evaluation-Tanzania (MEval-TZ) project offers an example of employing a “data use champion” strategy. This strategy was rolled out based on the recognition that providing one-time training and technical assistance is insufficient for fostering a lasting culture of data analysis and utilization within healthcare organizations. The project recognized that having an advocate within the system could serve as a catalyst for change by providing mentorship to others and promoting a culture of data demand and utilization

3. “Fit for purpose: it serves an intended decision-making function; Fit for use: getting the right information, into the right hands, at the right time” (17, pp.2).



among different teams. Training was conducted with regional and district-level data use champions to lead and sustain data use initiatives (20).

The Challenge Initiative for Healthy Cities (TCIHC)⁴ led by PSI India also offers insight into how data use has been enhanced at the last mile of the health system among frontline workers (see Box 4).

LEADERSHIP AND STAKEHOLDER ENGAGEMENT

Strong leadership is a key facilitator to promote the uptake of data or evidence into decision making processes and policy (7,5). This also entails political commitment from the government and the allocation of financial resources to support evidence-to-policy processes while fostering an enabling environment for informed decision making (21).

BOX 4

A 2BY2 MATRIX TO ENHANCE DATA USE AT THE LAST MILE

Under the Challenge Initiative for Healthy Cities (TCIHC), PSI developed a simple yet effective tool – a 2BY2 Matrix – to improve data use and decision-making at the last mile of the health system. Despite collecting a significant amount of data, frontline workers often failed to recognize its value in improving their day-to-day work and viewed it solely as a reporting requirement to their supervisors. The 2BY2 Matrix addressed this issue by providing a structured format that presents monthly information and trends of family planning (FP) users and non-users categorized by age for each health worker. It also gives clear denominator for FP non-users and women requiring re-supply or follow-up for FP products or services. This tool empowered frontline workers to make informed decisions on resource allocation and targeted interventions based on reliable and up-to-date data. It also improved monitoring and evaluation efforts by providing a comprehensive overview of family planning indicators at the local level. Additionally, the matrix facilitated a culture of prioritization by categorizing Urban Primary Health Centers (UPHCs) based on family planning performance, optimizing efficiency and resource planning.

DRIVING INFORMED DECISION MAKING

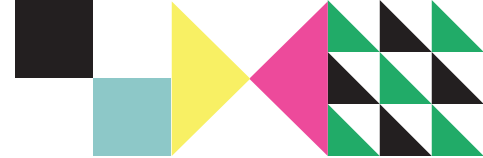
Numerous initiatives have emerged with the aim of harnessing the power of data to drive health system decision making, including the Country Health Information Systems and Data Use (CHISU) Program, the Data Use Partnership (DUP) in Tanzania, the Data for Implementation initiative (Data.Fi), and the digital tool for Outreach Training and Supportive Supervision Plus (OTSS+) under the PMI Impact Malaria project. Some of these initiatives focus on one vertical health area, but there may be potential for expanded scope over time to address other health areas.

- The **CHISU Program**, led by JSI Research & Training Institute, Inc. (JSI) and supported by USAID, aims to enhance country capacity, leadership, and self-

reliance in managing and utilizing high-quality health information systems for evidence-based decision making. This program has reported several success stories in multiple countries. For example, CHISU helped coordinate the implementation of WHO's data quality review tool to build capacity for data quality review in Niger; in Ghana, the program has enhanced malaria data analysis, interpretation, visualization, and use by activating a malaria e-tracker dashboard, updating training materials, and strengthening data utilization skills (22).

- The **Data Use Partnership (DUP)**, is a Tanzanian government-led initiative that builds digital systems, digital health governance structures,

4. The Challenge Initiative for Healthy Cities (TCIHC) was a four-year project supported by BMGF through Gates Institute, Johns Hopkins University, and led by PSI in India. The TCIHC was implemented in 31 cities in the states of Uttar Pradesh, Madhya Pradesh and Odisha to rapidly and sustainably scale up proven reproductive health solutions among the urban poor.



eLearning platforms, and national strategies and policies for a strong, connected digital ecosystem at all levels. The DUP uses data to track health system performance and inform policy and strategy directions through surveillance activities. Notably, it has developed the Afya Supportive Supervision System (AfyaSS), a digital facility supervision system that simplifies performance reviews and enables data-driven decision making (23).

- **Data.FI**, led by Palladium in collaboration with consortium partners, supports more than 20 countries to improve program performance through data. One of its key components is the use of Machine learning (ML), artificial intelligence (AI), and predictive analytics to equip decision makers with insight into what is likely to occur and to inform decision making and action to accelerate achievements across the HIV clinical cascade (24).

Many mobile applications have also been developed to improve decision making at all levels of the health system. One example is the **Electronic Community Health Information System (eCHIS)** that can be used by health workers as a data collection, reporting, visualization, clinical care, and decision-support tool (25). Another application is the **Open Smart Register Platform (OpenSRP)**, which is an “FHIR-compliant health solution that facilitates access to real-time, accurate data about the health of community members. It allows for better planning and decision-making, and for greater responsiveness to the health needs of the population”. OpenSRP has been rolled out in several countries, including Bangladesh, Zambia, Malawi, and Indonesia (26). Another example is the Go-Green app, an innovative technology-driven data management solution, which is being implemented by PSI in the Healthy Heart Africa (HHA) project across program sites in 18 Nigerian states and 360 public health facilities (see Box 5).

BOX 5

THE PSI GO-GREEN APP

This initiative aims to strengthen the health system in Nigeria by bringing efficiencies into the data process flow at the system level by addressing delays and inaccuracies at the pre-HMIS stage. Under current HMIS data flow, service utilization statistics are collected periodically from public health facilities, often resulting in errors due to manual computations over a long interval of time. Go-Green, a device-independent progressive web application, was developed through a human-centered design process to create a format to empower health providers with a user-friendly interface for daily generation of summary statistics. This approach proved highly effective, with providers embracing the Go-Green mobile app, finding it useful for viewing trends and making informed decisions, starting at the facility level. Across program sites in 360 public health facilities across 18 states, the Go-Green system was adopted voluntarily by almost all providers in a short time span. Real-time access to summary data was granted to health staff at all levels of the health system. Go-Green has the potential to replace inefficient manual summary data processes at the facility level, thereby strengthening the HMIS by enabling timely data analysis within a short period after the services are delivered, almost in real-time.

OTSS+ FOR SUPPORTIVE SUPERVISION

Impact Malaria, the flagship global service delivery project of the U.S. President’s Malaria Initiative (PMI), employs a digital tool for Outreach, Training, and Supportive Supervision Plus (OTSS+), a novel approach to supportive supervision at the facility level. This innovative method uses standard automated checklists, which focus on continually enhancing the competencies of healthcare providers in malaria diagnosis and treatment. The OTSS+ approach is built into an electronic tool, enabling Impact Malaria to collect and analyze service quality data in real time, allowing supervisors to provide targeted on-the-job training and coaching and to develop actions plans to address identified weaknesses.



ACMS employees work in the office in Yaounde.
PSI Cameroon/Association Camerounaise pour le
Marketing Social (local partner) August, 2010

CONCLUSION

Data interventions play a crucial role in strengthening health systems and shaping informed decisions. A strong health information system, driven by high-quality, timely, and integrated data, is the backbone of a resilient, sustainable, and people-centered health system. However, numerous challenges must be addressed to fully harness the potential of health data. The issue of fragmented data within the health system represents a significant barrier that makes it challenging to gain a comprehensive understanding of health service delivery, identify bottlenecks, and make informed decisions. Additionally, not having access to the right data, poor quality of data, and limited data analysis and interpretation skills, particularly at the sub-national level, further impede data utilization.

There are promising solutions and key learnings that can help overcome these challenges. Adopting common standards, such as FHIR, holds the potential to address fragmentation and enhance interoperability.

JOIN US

As we share insights and reflections across these themes, we invite you to share and reflect with us through honest and constructive discussions that do not only focus on what we know, but that also acknowledge what we do not know, and that do not only highlight what works, but that also recognize what does not work. We also hope that these interactions will lead to new partnerships that will ultimately benefit consumers for the long-term – partnerships that shape health systems in which they can more easily access the quality, affordable, essential health services and products they need.

Additionally, enhancing continuity of care through digital solutions, improving data utilization through user-centered design, and fostering a culture of data demand and utilization all can contribute to harnessing the power of data within health systems.

Many of the initiatives mentioned in this paper are donor-funded. It is therefore important to understand how these donor-funded initiatives are adopted and taken to scale in a sustainable way. Sustained effectiveness of data use initiatives should be assessed to better understand whether and how they contribute to health systems strengthening efforts and to improved health outcomes. The HSS community should invest in solutions with proven efficacy and lasting effect on health information systems that are not health area specific, and that empower decision-makers to leverage high quality data for policy making, service delivery and disease surveillance, ultimately enhancing both access to and quality of care for consumers.

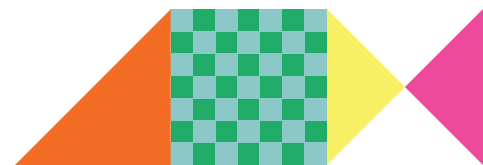
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REFERENCES

1. World Health Organization (2005). Health information systems: the foundation of public health. Bulletin of the World Health Organization, 83 (8). <https://apps.who.int/iris/rest/bitstreams/1092654/retrieve>
2. OECD (2019). Health in the 21st Century: Putting Data to Work for Stronger Health Systems, OECD Health Policy Studies, OECD Publishing, Paris. <https://doi.org/10.1787/e3b23f8e-en>.
3. Li, M., Brodsky, I. & Geers, E. (2018). Barriers to use of health data in Low- and Middle-Income Countries. A review of the literature. MEASURE Evaluation.
4. Wickremasinghe, D., Hashmi, I. E., Schellenberg, J., & Avan, B. I. (2016). District decision-making for health in low-income settings: A systematic literature review. Health Policy and Planning, 31 Suppl 2(Suppl 2), ii12–ii24. <https://doi.org/10.1093/heapol/czv124>.
5. Boo, Y. Y., Gwacham-Anisiobi, U., Thakrar, D. B., Roberts, N., Kurinczuk, J. J., Lakhanpaul, M., & Nair, M. (2023). Facility-based stillbirth review processes used in different countries across the world: A systematic review. EClinicalMedicine, 59, 101976. <https://doi.org/10.1016/j.eclinm.2023.101976>
6. Garrib, A., Stoops, N., McKenzie, A., Dlamini, L., Govender, T., Rohde, J., & Herbst, K. (2008). An evaluation of the District Health Information System in rural South Africa. South Africa Medical Journal, 98(7):549-52.
7. Sakala, M., Chawani, M. S., Kazanga-Chiumia, I., Hara, H., Abdullahi, L., Kambalame, D., Banda, J., Mitambo, C., Terlouw, A., & Oranje, R. (2023). Functionality of technical working groups in enabling evidence-informed decision-making within Malawi's Ministry of Health: A cross-sectional qualitative study. Health Research Policy and Systems, 21(1), 44. <https://doi.org/10.1186/s12961-023-00987-7>.
8. Bhattacharyya, S., Issac, A., Girase, B., Guha, M., Schellenberg, J., & Iqbal Avan, B. (2020). "There Is No Link Between Resource Allocation and Use of Local Data": A Qualitative Study of District-Based Health Decision-Making in West Bengal, India. International Journal of Environmental Research and Public Health, 17(21). <https://doi.org/10.3390/ijerph17218283>.
9. World Health Organization (2020). Private Sector Landscape in Mixed Health Systems. Geneva: World Health Organization. https://hlh.who.int/docs/librariesprovider4/private-sector/private-sector-engagement---private-sector-landscape-in-mixed-health-systems---conference-copy.pdf?sfvrsn=99c6944d_13
10. Ndlovu, K., Scott, R. E., & Mars, M. (2021). Interoperability opportunities and challenges in linking mhealth applications and eRecord systems: Botswana as an exemplar. BMC Medical Informatics and Decision Making, 21(1), 246. <https://doi.org/10.1186/s12911-021-01606-7>
11. Walcott-Bryant, A., Ogallo, W., Remy, S. L., Tryon, K., Shena, W., & Bosker-Kibacha, M. (2021). Addressing Care Continuity and Quality Challenges in the Management of Hypertension: Case Study of the Private Health Care Sector in Kenya. Journal of Medical Internet Research, 23(2), e18899. <https://doi.org/10.2196/18899>
12. Digital Square (2020). Digital and data briefs: Interoperability. https://static1.squarespace.com/static/59bc3457ccc5c5890fe7cacd/t/5f74f14221bcd626e652310c/1601499459906/Interoperability+Brief_30+Sep+2020.pdf
13. Digital Transformation Office (DTO) (2022). Towards Electronic Medical Record Implementation, the MoH Indonesia Held a Technical Working Group on Health Information System. Available at: <https://www.linkedin.com/pulse/towards-electronic-medical-record-implementation-moh-indonesia->
14. Path & Ministry of Health [Tanzania]. (n.d.). Data Use Partnership Journey. <https://www.moh.go.tz/storage/app/media/uploaded-files/Data%20Use%20Partnership%20Journey.pdf>
15. National Data and Analytics Platform (n.d). <https://vikaspedia.in/e-governance/digital-india/national-data-and-analytics-platform>
16. Population Services International (2023). A Digital Ecosystem for Community-Driven Integrated tuberculosis Screening and Testing Service Delivery. Blog. <https://www.psi.org/2023/06/making-tuberculosis-care-easier/>
17. Barbazza, E., Klazinga, NS., & Kringos, DS. (2021). Exploring the actionability of healthcare performance indicators for quality of care: a qualitative analysis of the literature, expert opinion and user experience. BMJ Qual Saf, 30(12):1010-1020. doi: 10.1136/bmjqs-2020-011247.

18. Mutale, W., Chintu, N., Amoroso, C., Awoonor-Williams, K., Phillips, J., Baynes, C., Michel, C., Taylor, A., & Sherr, K. (2013). Improving health information systems for decision making across five sub-Saharan African countries: Implementation strategies from the African Health Initiative. *BMC Health Services Research*, 13 Suppl 2(Suppl 2), S9. <https://doi.org/10.1186/1472-6963-13-S2-S9>
19. Edwards, A., Zweigenthal, V., & Olivier, J. (2019). Evidence map of knowledge translation strategies, outcomes, facilitators and barriers in African health systems. *Health Research Policy and Systems*, 17(1), 16. <https://doi.org/10.1186/s12961-019-0419-0>
20. Measure Evaluation (2018). Improving use of health data through data use champions.
21. Uneke, C.J., Sombie, I., Keita, N., Lokossou, V., Johnson, E., & Ongolo-Zogo, P. (2017). Improving maternal and child health policymaking processes in Nigeria: an assessment of policymakers' needs, barriers and facilitators of evidence-informed policymaking. *Health Res Policy Sys*, 15 (Suppl 1). <https://doi.org/10.1186/s12961-017-0217-5>
22. CHISU Results in action 2023, <https://chisuprogram.org/news/success-stories>
23. Tanzania Ministry of Health, Afya supportive supervision system impact evaluation report, September 2022.
24. Data for Implementation [internet], <https://datafi.thepalladiumgroup.com/about/3>
25. John Snow, Inc. Digitizing Community Health Information Systems: What's next to improve health service delivery at the community level in Ethiopia?, <https://www.jsi.com/digitizing-community-health-information-systems-whats-next-to-improve-health-service-delivery-at-the-community-level-in-ethiopia/>
26. Make healthcare universal [internet], <https://opensrp.io/>
27. Pan American Health Organization (2022). Interoperability in Public Health. Digital Transformation Toolkit