



Bridging the rehabilitation data gap in Uganda: A case study exploring the implementation of the WHO routine health information system – Rehabilitation module

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ABSTRACT

Uganda's Health Management Information System (HMIS) has historically lacked robust, standardized data on rehabilitation and assistive technology (AT) services, limiting effective policy development and service planning. To address this gap, the Ministry of Health sought to integrate the WHO Routine Health Information System (RHIS) – Rehabilitation module into the national digital reporting platform (DHIS2). This mixed-methods explanatory case study adopted the Consolidated Framework for Implementation Research (CFIR) to examine the multi-level processes, determinants, and context influencing integration. The WHO RHIS-Rehabilitation module was integrated through stakeholder engagement, indicator consensus-building, customized tool development, and targeted capacity-building. Six core rehabilitation indicators were prioritized and launched in DHIS2 across 25 referral facilities. The process revealed persistent challenges, including infrastructure constraints, limited workforce capacity, and competing health-sector priorities. Nonetheless, substantial improvements were observed in data standardization, stakeholder engagement, and foundational digital reporting capacity for rehabilitation services. Integrating the WHO RHIS-Rehabilitation module into Uganda's HMIS marks a significant advancement for rehabilitation information systems in resource-limited settings. Key lessons highlight the necessity of early policy alignment, ongoing capacity building, and continuous stakeholder support to sustain and expand rehabilitation data integration. This experience provides a practical pathway for strengthening rehabilitation data systems in comparable contexts.

1. Introduction

The global need for rehabilitation services is increasing because of the rising prevalence of noncommunicable diseases (NCDs), injuries, and aging populations (Ghaffar et al., 2024). One in three people worldwide lives with a health condition that may require rehabilitation, yet more than 50% of these needs in low- and middle-income countries (LMICs) remain unmet (Cieza et al., 2021). In Uganda, 7.5 million people needed rehabilitation services in 2021, with 26% of the population requiring at least one or more assistive technology (AT) product to

support their daily functioning. However, only 5% of Ugandans who need an AT product can access it. In comparison, 21% of the population reported unmet needs for AT, reflecting severe deficiencies in availability and affordability, disproportionately affecting women and rural communities (Ministry of Health, Uganda MoH, 2023). Investment in rehabilitation and AT enables individuals to achieve and maintain optimal functioning, improve health outcomes, and enhance participation in daily life (World Health Organization, 2019). Simultaneously, establishing a comprehensive and integrated data management system for rehabilitation care is critically important. The WHO Rehabilitation

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2030: Call for Action emphasizes the importance of strengthening Health Management Information Systems (HMIS) to ensure timely and quality data collection for rehabilitation services (World Health Organization, 2023). This data is critical for defining rehabilitation targets, monitoring outcomes, supporting clinical decision-making, and informing quality management. Routine data reporting from health facilities, integrated into national HMIS, provides essential insights into service availability, distribution, and performance, helping countries achieve Universal Health Coverage (UHC) (World Health Organization, 2025a).

Uganda's national HMIS, based on the District Health Information Software 2 (DHIS2) platform, has historically lacked standardized rehabilitation and AT services indicators (Learning, Acting, and Building for Rehabilitation in Health Systems ReLAB-HS, 2024). This gap has impeded the systematic documentation of rehabilitation requirements and service delivery, making it difficult for policymakers to prioritize rehabilitation, monitor service availability, allocate resources effectively, and address care gaps. Compounding these challenges, reliance on paper-based data collection further exacerbates issues with data completeness, timeliness, and quality. Health facilities in Uganda face competing demands, limited infrastructure, workforce shortages, and inconsistent reporting practices, particularly in rural and district settings (Umezuruike and Nwankwo, 2017). In response, during the mid-term review of its HMIS, Uganda's Ministry of Health (MoH) undertook the opportunity to mainstream rehabilitation and AT data within the HMIS.

The Learning, Acting, and Building for Rehabilitation in Health Systems (ReLAB-HS) Project, funded by the former United States Agency for International Development (USAID) and led by Johns Hopkins Bloomberg School of Public Health, in collaboration with the WHO and MoH of Uganda integrated the WHO's Routine Health Information System (RHIS) – Rehabilitation Module into the national HMIS (World Health Organization, 2024a, 2024b) (Box 1). This integration process aims to enhance data collection, improve the visibility of rehabilitation services, and inform health policies and strategic resource allocation, thereby enabling Uganda to better respond to increasing rehabilitation needs and ensure equitable, accessible, and high-quality care (World Health Organization, 2024c).

Generally, configured RHIS modules for DHIS2 are a key WHO product that supports countries in ensuring global data standards and data-use practices across priority programs, including HIV, TB, immunization, and COVID-19. These digital health packages are configurable bundles that combine indicator standards, metadata, dashboards, and

training materials (Poppe et al., 2021). However, their adoption in countries has required substantial local “mapping and tinkering” rather than just a plug-and-play integration (Poppe et al., 2021). Experiences from other DHIS2 implementations highlight that a digital platform alone does not guarantee high-quality, routinely used data; instead, data quality and use depend on alignment with work practices, institutional arrangements, and local capacity for data interpretation and feedback (Byrne and Sæbø, 2022; Nuwasiima et al., 2025; Zerfu et al., 2024). This growing literature has, however, primarily focused on cross-program digital packages or on data quality and use for high-priority conditions, with limited attention to rehabilitation.

This paper examines the integration of the WHO RHIS-Rehabilitation module into Uganda's national HMIS through an implementation science lens. Specifically, the objective of this study is to identify the implementation processes, determinants, and contextual factors that facilitate the integration of this standardized module into national HMIS in resource-limited settings. Using the Consolidated Framework for Implementation Research (CFIR) (Damschroder et al., 2022), we developed a comprehensive case study to understand how and why the WHO RHIS-Rehabilitation module integration unfolded as it did, focusing on the multi-level processes and strategic decisions that shaped this digital health transformation within Uganda's DHIS2 platform.

2. Methods

2.1. Study Design

This study employed a mixed-methods explanatory case study design to examine the integration of the WHO RHIS-Rehabilitation module into Uganda's national HMIS. Case study methodology is well-suited to investigating complex, contemporary phenomena in real-world contexts, particularly when the boundaries between a phenomenon and its context are not clearly defined (Yin, 2018). We selected this explanatory mixed-method approach to describe how and why the integration process unfolded as it did, using multiple perspectives and data sources, focusing on the implementation determinants, contextual factors, and strategic processes that influenced this digital transformation (Crowe et al., 2011). We have described the integration process across multiple organizational levels, from national policymakers to facility-level rehabilitation personnel, with a focus on the context of Uganda's health system (Creswell and Clark, 2018).

Box 1

A Snapshot of the Routine Health Information System (RHIS) for Rehabilitation.

WHAT IS A ROUTINE HEALTH INFORMATION SYSTEM (RHIS)?

RHIS collects facility-level data from healthcare workers, offering timely insights into service performance and quality while advancing an integrated environment for program-specific and cross-cutting data use (World Health Organization, 2025b).

WHAT IS A HEALTH MANAGEMENT INFORMATION SYSTEM (HMIS)?

HMIS is the national platform for routinely collecting, processing, analyzing, and reporting health service data, within which RHIS function as facility-level subsystems that generate and feed standardized data (Global Health Data Methods, 2025). In many LMICs, platforms such as DHIS2 serve as the principal electronic HMIS (About DHIS2, 2025), enabling integration, aggregation, and use of RHIS data.

WHY IS THE STRENGTHENING OF RHIS FOR REHABILITATION NEEDED?

Strengthening rehabilitation in health systems requires timely, quality data from RHIS to assess sector capacity, performance, and inform decision-making on accessibility, availability, workforce, quality, and outcomes. This supports real-time planning and responsive measures to meet population needs.

WHAT IS WHO'S RHIS - REHABILITATION TOOLKIT?

WHO RHIS – Rehabilitation toolkit provides a standardized framework for collecting and analyzing rehabilitation service data (World Health Organization, 2024a). It includes indicators grouped by facility type, a DHIS2-compatible digital package for reporting and quality assurance, and training resources for data analysts and entry staff. The toolkit supports monitoring national rehabilitation priorities, integrating services into health systems, and advancing UHC goals by guiding Member States in capturing facility-level data.

2.2. Conceptual Model for Exploring the Integration of the WHO RHIS-Rehabilitation Module

The integration of the WHO RHIS-Rehabilitation module into Uganda's national HMIS employed a pragmatic approach. However, in this case study, we adopted the CFIR framework, which provided a structured approach for elaborating on the integration process. CFIR is a meta-theoretical framework based on implementation science (Damschroder et al., 2022, 2009), organized across five major domains to capture the dynamic interplay between innovation (intervention) characteristics, outer and inner settings, individual factors, and implementation processes that collectively determine implementation outcomes (Kirk et al., 2016). It has demonstrated effectiveness in describing the implementation process of health information systems (HIS) in similar African contexts, such as Ethiopia, Mozambique, Rwanda, and Zambia (Degaga et al., 2025; Gimbel et al., 2017; Hailemariam et al., 2023). Fig. 1 illustrates the conceptual framework of this case study, developed based on CFIR domains and their application to the Ugandan context.

In the conceptual framework, the Innovation Domain focused on WHO RHIS-Rehabilitation module characteristics, the Implementation Process examined activities and strategies used for integration, the Inner Setting captured facility-level organizational factors, and the Outer Setting encompassed national health policies and external pressures. However, since our case study centered on integrating a digital innovation, the WHO RHIS-Rehabilitation module, into an existing legacy HMIS system rather than implementing an intervention within organizational units led by individual champions, we operationalized the Individuals Domain differently than the original CFIR framework. The standard CFIR Individuals Domain focuses on personal adopter characteristics, motivation, and leadership roles that influence how individuals accept or resist innovation. In our paper, the primary "recipient" of the WHO RHIS-Rehabilitation module was not a discrete group of

individuals but rather Uganda's institutionalized Legacy HMIS System and its paper-based data architecture, existing rehabilitation indicators, established reporting workflows, and embedded practices.

2.3. Data Sources and Analytical Approach

The study drew on both quantitative and qualitative data to address the 'why' and 'how' of the integration process for triangulating findings from diverse perspectives and contexts. We sourced quantitative data from Uganda's national HMIS using the DHIS2 platform, leveraging routine facility-level reporting. This included aggregated annual and monthly data on rehabilitation and AT indicators from the year 2020–2021, which is part of the legacy HMIS system. Facility-level registers, DHIS2 digital records, and national population projections from the Uganda Bureau of Statistics provided foundational datasets for numerators and denominators required for indicator calculation and analysis. The study further incorporated results from the 2023 Uganda rapid Assistive Technology Assessment (rATA) household survey (Ministry of Health, Uganda MoH, 2023), which provided additional data on population-level needs, access, unmet demand, and barriers for AT. Other quantitative data were included from the rapid readiness assessments conducted at 12 National and Regional Referral Hospitals and at the national level, as part of the WHO RHIS-Rehabilitation module integration process. This assessment collected data on rehabilitation infrastructure, workforce, data-capture practices, and digital readiness using standardized questionnaires and WHO-developed checklists.

Qualitative data were derived from multiple complementary sources designed to capture implementation context, stakeholder attitudes, and process complexity. Regular communication and stakeholder consultation with key informants (including MoH officials, facility managers, rehabilitation professionals, HMIS data managers, and healthcare providers) were documented in meeting minutes, which provided detailed

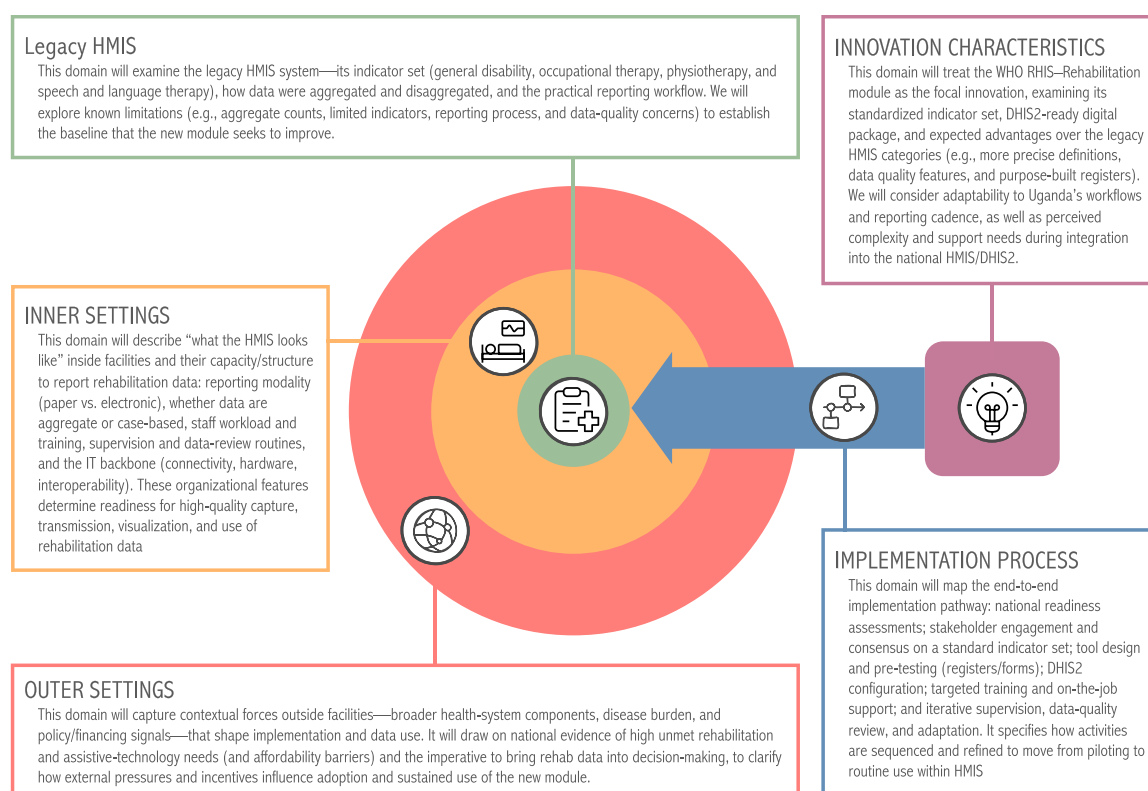


Fig. 1. Conceptual framework of the case study based on Consolidated Framework for Implementation Research (CFIR), exploring the integration of the WHO RHIS-Rehabilitation Module into the national health information management system of Uganda.

insights into readiness, barriers, facilitators, and perceptions of the RHIS-Rehabilitation Module integration. Documentation review formed another qualitative evidence base, encompassing policy documents (Ministry of Health, Uganda MoH, 2023), technical guidance notes (Learning, Acting, and Building for Rehabilitation in Health Systems ReLAB-HS, 2024; World Health Organization, 2024c), standard operating procedures, records of indicator selection, and tool development workshops (Adair et al., 2024). These sources highlighted the chronology of stakeholder engagement, the negotiation and consensus-building processes during indicator adaptation, and the real-time challenges and innovations encountered throughout implementation. The study also utilized narrative comments and reflective logs from implementing partners and trainers, which contextualized quantitative findings and revealed adaptations made in response to emergent constraints (e.g., infrastructure deficits, staff shortages, digital transition challenges, and COVID-19 disruptions).

We synthesized data using an integrative and iterative framework-based approach aligned with the CFIR domains. We conducted descriptive statistical analyses of quantitative facility and national service data and reported on regional disparities, data quality (including completeness, consistency, and timeliness), and service uptake of legacy HMIS indicators. The readiness assessment findings were tabulated and compared across sites to identify patterns of infrastructure gaps, human resource constraints, and IT readiness. The population-level summary statistics of rATA helped to contextualize community need and system responsiveness. Qualitative materials underwent thematic content analysis aligned with the CFIR domains (innovation, implementation process, inner and outer setting, and individual characteristics). We developed analytical matrices to examine relationships among determinants, barriers, and facilitators, ensuring that cross-cutting themes and contradictory evidence were adequately captured. To present the findings of this case study, we integrated quantitative and qualitative evidence through iterative narrative synthesis, and synthesized actionable lessons from the Ugandan case, which will be applicable for broader HIS strengthening in comparable settings.

3. Results

The Results section is organized according to five key domains that shaped the integration of the WHO RHIS-Rehabilitation module into Uganda's national HMIS. We begin by examining the legacy HMIS to establish the baseline context and limitations that led to the change, including existing rehabilitation data-collection practices and their constraints. The Inner Setting domain focuses on facility-level factors, including organizational characteristics, infrastructure capacity, staff readiness, and local implementation climate. The Outer Setting domain examines macro-level contextual factors (including national health policies, external partnerships, and system-wide pressures) that influenced implementation decisions and sustainability. Next, we described the innovation characteristics of the WHO RHIS-Rehabilitation module, exploring its design features and the adaptations made to its indicator set for Uganda. Finally, the Implementation Process domain details the systematic activities and strategies employed throughout the integration process, from initial planning and stakeholder engagement through training, deployment, and ongoing adaptation.

3.1. Legacy HMIS and Reporting of Existing Rehabilitation Indicators

Uganda's health information landscape underwent a significant transformation in 2011–12 when the MoH implemented the DHIS2 as its national HMIS, replacing fragmented paper-based reporting mechanisms (Kiberu et al., 2014). This transition established a standardized platform for collecting, aggregating, and reporting health data across the country's health system. Despite this digital advancement, rehabilitation and AT services remained inadequately captured within the national HMIS framework. The reporting system of the facilities captures a

limited scope of rehabilitation conditions across four broad categories: general disability (13 conditions), occupational therapy (14 conditions), physiotherapy (17 conditions), and speech and language therapy (7 conditions) (Table 1). The data elements comprised a heterogeneous mix of functional conditions (e.g., visual and hearing impairments) and clinical diagnoses (including complex neurological disorders), as well as AT device provisions. This inconsistent categorization complicates systematic data analysis and cross-condition comparisons. Data collection follows standardized demographic disaggregation protocols, with each condition reported by sex and broad age groups (0–28 days, 29 days–4 years, 5–9 years, 10–19 years, 20 + years). However, the aggregated nature of reporting means that the data represent total consultation sessions rather than unique individuals, potentially including multiple visits by the same patients during the reporting period.

Within the existing HMIS architecture, the legacy rehabilitation and AT-related data elements were collected from individual patients during care provision at health facilities and recorded in outpatient registries. These data are subsequently transcribed into paper-based Health Unit Outpatient Monthly Reports at each health facility before being transmitted to the district level, where they are manually entered into the DHIS2 system (Fig. 2). This multi-step process creates multiple opportunities for data quality deterioration and reporting inconsistencies.

Analysis of 2020–2021 legacy rehabilitation and AT-related data elements revealed significant systemic challenges that undermine the utility of rehabilitation data for health system planning and policy formulation. The data demonstrated consistently low reported utilization of rehabilitation services across all regions, with substantial temporal geographical variations that could not be explained by population demographics or service availability alone. Critical data quality concerns emerged during the review of HMIS data, characterized by inconsistent reporting patterns in which health units reported high numbers of specific conditions in one year, followed by significantly fewer cases in subsequent periods (Fig. 3). This erratic reporting pattern suggests fundamental issues with data collection protocols, staff training, or understanding of case definitions, rather than genuine fluctuations in service demand or provision. Moreover, the legacy indicators fail to offer valuable insights into service utilization, patient outcomes, or specific quality measures, such as outreach activities and waiting times.

Table 1

List of existing rehabilitation-specific indicators in the legacy national HMIS in Uganda.

No	Data element	Number of conditions included	Example
1	Number of individuals with a specific disability	13	Difficulty seeing, difficulty hearing, etc.
2	Number of individuals with specific physiotherapy conditions	17	muscular disorders, joint dysfunction, etc.
3	Number of individuals with specific physiotherapy conditions who were prescribed assistive devices	17	–
4	Number of individuals with specific occupational therapy conditions	14	Neurodevelopmental Disorders, orthopedic conditions, etc.
5	Number of individuals with specific occupational therapy conditions who were prescribed assistive devices	17	–
6	Number of individuals with specific speech/language therapy conditions	7	Speech and language delay/disorder, motor speech disorders, etc.

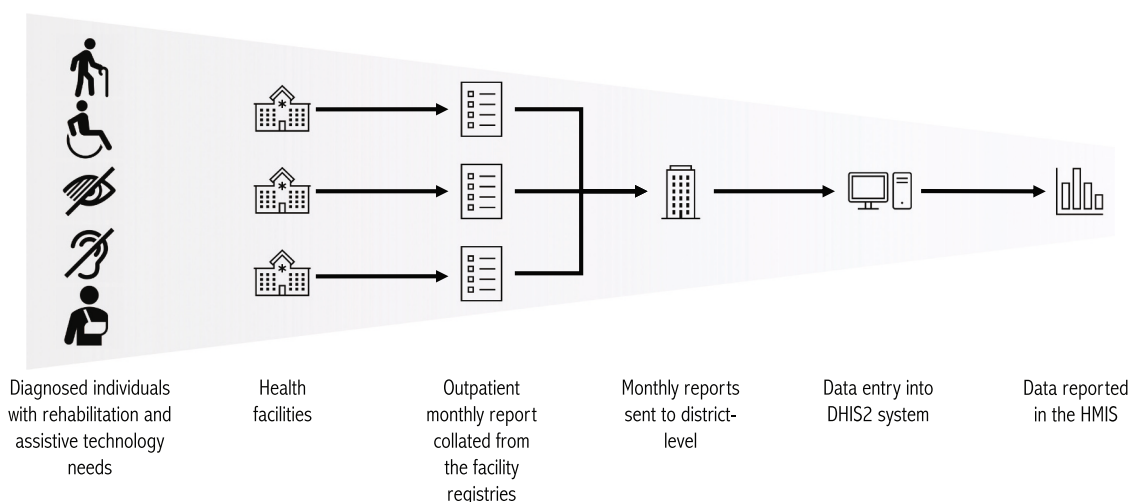


Fig. 2. Information Flows of the legacy national HMIS in Uganda, which only captured rehabilitation-specific indicators at the outpatient facilities.

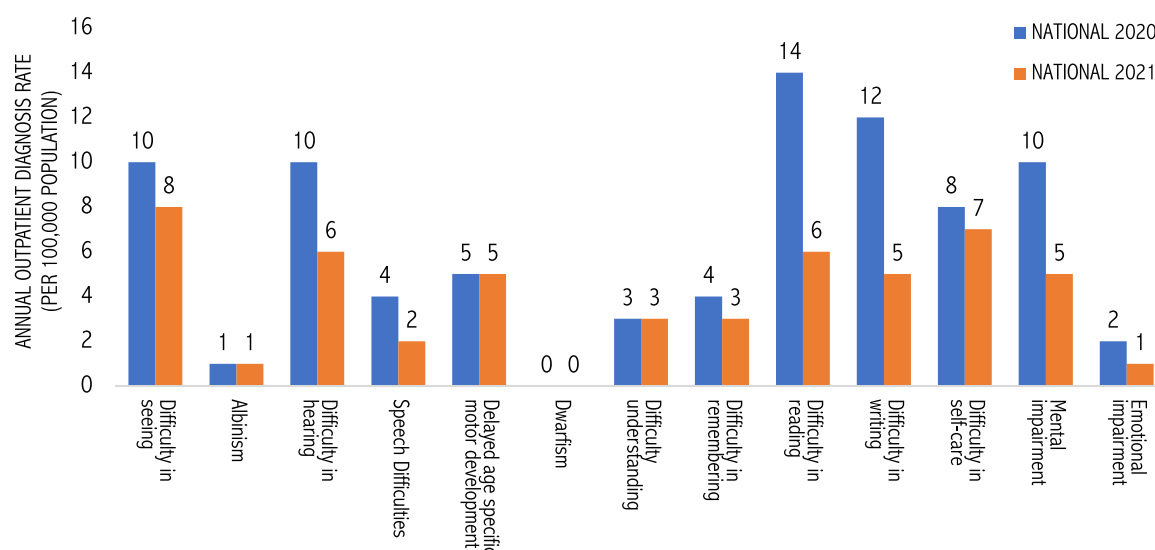


Fig. 3. Annual outpatient diagnosis rate (per 100,000 population) reported based on the rehabilitation indicator in the national health information management system in Uganda, 2020–2021.

3.2. Inner Setting of the Health Management Information System

At the facility level, rehabilitation data collection in Uganda operates primarily through fragmented, paper-based systems that lack standardization and integration with the national HMIS. The Rapid Readiness Assessment, conducted across a sample of 12 Regional and National Referral Hospitals in 2023 in preparation for the implementation of the WHO RHIS-Rehabilitation module, revealed that paper-based reporting was widely used at 9 out of 11 sites providing information, while only two facilities—Soroti and Butabika—utilized electronic systems. Individual rehabilitation units collect basic information on patient frequencies and primary conditions, but this data remains largely disconnected from broader facility reporting mechanisms. Staff capacity for data collection and reporting was identified as a critical constraint, with nine sites, excluding Lira and Moroto, reporting inadequate capacity for systematic data collection. The limitations of standardized data collection forms, registers, and indicators for rehabilitation further compound these challenges, as facilities rely on improvised documentation methods that vary significantly across different rehabilitation service units, including physiotherapy, occupational therapy, and

orthopedic workshops.

The organizational readiness analysis revealed significant gaps in supervision, training, and data quality assurance mechanisms that directly impact rehabilitation data reporting. Only five facilities—Jinja, Kabale, Moroto, Soroti, and Butabika—had established data quality processes, while eight facilities shared data with the MoH; however, only three adhered to disease coding standards. Information technology support was available at seven sites, with infrastructure components such as Local Area Networks (LANs), servers, and internet connectivity provided by the government; however, computer availability varied across facilities. Training on data reporting, quality, analysis, and DHIS2 was provided at seven hospitals, but comprehensive HMIS procedures were available at only six facilities. The supervision and monitoring processes indicated that seven sites had performance-monitoring teams that met monthly or quarterly. However, only four used standard records, with barriers including the unavailability of standard records and inadequate staff training on their use. The Systematic Assessment of Rehabilitation Situation (STARS) also confirmed these deficiencies, noting fragmented data collection by rehabilitation units lacking collation and consolidation mechanisms (Ministry of Health, Uganda MoH,

2023).

At the national level, the current HMIS architecture presents both opportunities and significant barriers for rehabilitation data integration. The current DHIS2, as an electronic HMIS, is a robust platform that can accommodate rehabilitation data through the newly developed WHO RHIS-Rehabilitation module. However, rehabilitation and AT data are not integrated into either the national HMIS or the complementary Community Health Management Information System (CHMIS), creating a substantial gap in systematic monitoring and evaluation. The STARS indicates that rehabilitation data are not reflected in decision-making and reporting at central policymaking and regional levels, with minimal research on rehabilitation and AT in Uganda. The fragmented approach to data collection across rehabilitation units, coupled with inadequate collation, consolidation, and reporting mechanisms, reflects broader systemic challenges in transforming facility-level information into actionable intelligence for policy and resource-allocation decisions.

3.3. Outer Setting of the Health Management Information System

The broader health system presented some structural challenges that influence the adoption and sustained use of the WHO rehabilitation module within Uganda's HMIS. Rehabilitation services in Uganda face substantial gaps in accessibility and workforce distribution. Services are primarily concentrated in public National and Regional Referral Hospitals and private health facilities, while district hospitals and lower-tier facilities remain underserved. Of the 1022 registered rehabilitation professionals, including physiotherapists, occupational therapists, and orthopedic technologists, only 198 were accredited and practicing in the public sector in 2022. The rapid readiness assessment also revealed critical gaps in rehabilitation service delivery infrastructure, with most facilities lacking dedicated rehabilitation wards and operating with severely constrained human resources. Workforce shortages are particularly acute, with speech and language therapists completely absent from all surveyed facilities, audiologists available at only one site (Soroti), and specialized physical medicine and rehabilitation doctors unavailable across the entire network (Fig. 4). Thus, the current market gap in rehabilitation services is increasingly filled by private providers, non-governmental organizations (NGOs), and faith-based organizations.

Health Policy and financing strategies within Uganda's health system create mixed incentives for rehabilitation data integration,

reflecting broader sectoral priorities that have historically marginalized rehabilitation services. The STARS revealed that while rehabilitation was positioned within the MoH under the Division of Disability and Rehabilitation, it lacked substantive integration into the Health Sector Development Plan 2021–2024. The plan primarily emphasized rehabilitation in the context of physical infrastructure restoration rather than clinical service development.

Financing rehabilitation care posed additional challenges, as services were heavily dependent on inconsistent donor support and limited government investment, resulting in high out-of-pocket costs for patients. The absence of a dedicated national rehabilitation strategy or policy framework limited the institutional mandate for systematic data collection and reporting. Also, accountability and transparency mechanisms in the health sector did not encompass all rehabilitation services, making it difficult to track national performance and status. These policy gaps create an environment in which rehabilitation data may be perceived as nonessential, potentially undermining staff motivation and organizational commitment to the rigorous data-collection protocols required for effective implementation of the WHO RHIS-Rehabilitation module.

Beyond the health sector, Uganda faces substantial rehabilitation needs, underscoring the critical importance of establishing robust data systems. However, social and economic barriers significantly constrain access to services. National estimates indicate that approximately one in five Ugandans (7.5 million people) require rehabilitation services, while one in ten experiences functional difficulties requiring rehabilitation and assistive technology. The Rapid Assistive Technology Assessment (rATA) revealed that 26% of Ugandans require at least one assistive product, yet only 5% have access (Ministry of Health, Uganda MoH, 2023). Critically, the sources of AT products demonstrate the limited role of public sector provision, with only 15% of users obtaining devices through public facilities, while 85% access products through NGOs/charities (27%), self-made solutions (25%), friends/family (19%), or private sector providers (14%) (Fig. 5) (Ministry of Health, Uganda MoH, 2023).

This pattern creates a substantial data blind spot for the HMIS, as the vast majority of rehabilitation and AT interventions outside the government health system are not captured in DHIS2 reporting systems. These contextual forces create external pressure for improved rehabilitation data systems as evidence-based advocacy tools, while

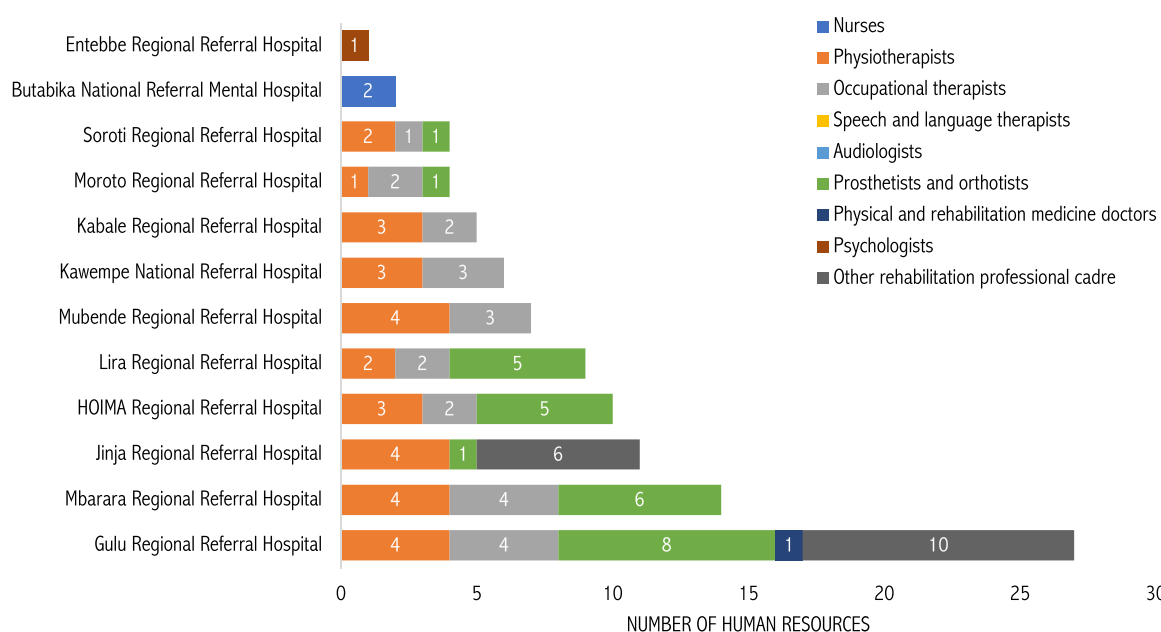


Fig. 4. Number of different types of human resources allocated to the rehabilitation department at the National and Regional Referral hospitals, which are included in the rapid readiness assessment.

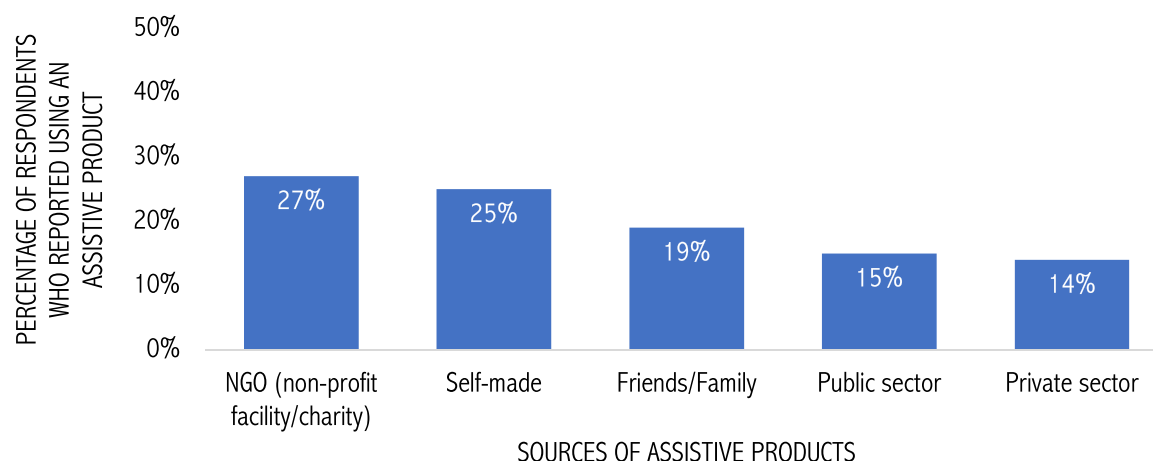


Fig. 5. Source of assistive product among those who reported use.

simultaneously presenting implementation challenges related to low service utilization rates, geographic accessibility constraints, and the complex socioeconomic factors that influence both healthcare-seeking behavior and the capacity of health facilities to systematically document and report rehabilitation service delivery.

3.4. The Innovation: WHO RHIS-Rehabilitation module

The WHO RHIS – Rehabilitation module represents a significant advancement over Uganda’s legacy rehabilitation data collection framework. Unlike the existing system’s inconsistent categorization approach, which combines heterogeneous data elements across disease and functional categories, the WHO RHIS module provides a standardized, comprehensive framework for systematic rehabilitation data

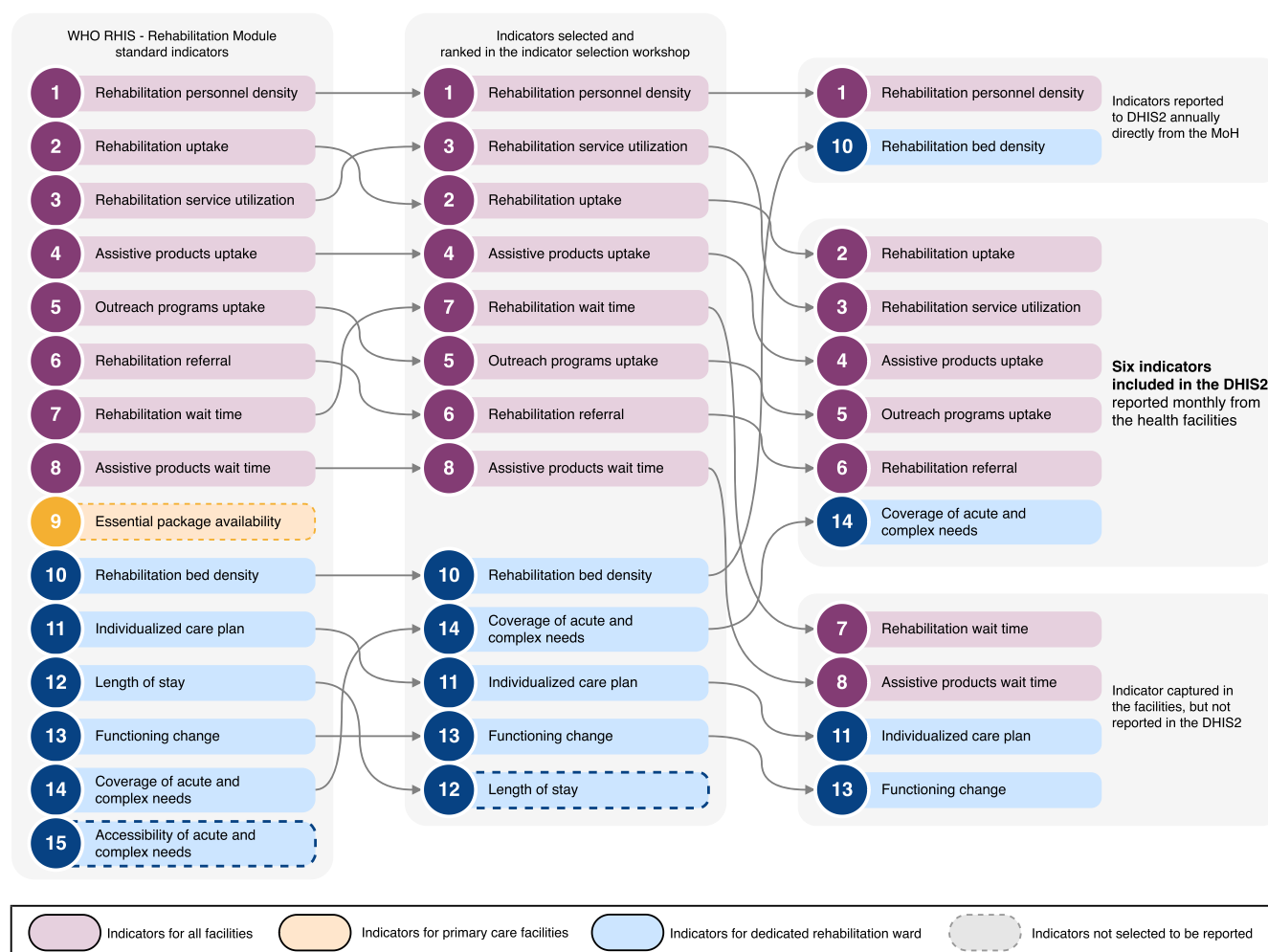


Fig. 6. Indicator selection process and list of final rehabilitation indicators integrated into Uganda’s DHIS2.

capture and analysis. This module comprises 15 indicators: eight core indicators applicable to all health facilities, one for primary care facilities, and six for facilities with dedicated rehabilitation wards (World Health Organization, 2024a). These indicators cover critical aspects of rehabilitation services, AT product provision, and patient outcomes (see [Supplementary Material 1 for the list of indicators and definitions](#)) (World Health Organization, 2022).

This DHIS2-compatible configuration package was designed for integration with existing national health information platforms, while purpose-built data-collection registers ensure consistent documentation protocols across facilities. Built-in data quality assurance features include validation rules, automated outlier detection, and consistency checks. The standardized analysis framework enables cross-facility comparisons and trend monitoring through dashboards organized according to the rehabilitation results chain, spanning input, output, outcome, and efficiency domains. Training resources are designed for both data-entry staff and program managers, ensuring sustainable implementation across organizational levels.

The integration of the WHO RHIS – Rehabilitation module into Uganda's National HMIS, as part of the DHIS2 platform, was not straightforward. It was implemented through a structured, multi-step strategy detailed in [Section 3.5](#) and involved a comprehensive review process to align with national health priorities. After the review, Uganda's MoH selected six core indicators from the original 15 for integration into the national DHIS2 platform. The finalized indicator set includes rehabilitation personnel density, rehabilitation service utilization, rehabilitation uptake, assistive products uptake, outreach programs uptake, and rehabilitation referral ([Fig. 6](#)). While additional indicators, including waiting times, individualized care plans, and functional changes, will be captured in facility registers, their integration into digital reporting systems awaits future HMIS digitization. This phased approach reflects Uganda's pragmatic balance between comprehensive data needs and implementation feasibility,

establishing a foundation for progressive expansion of rehabilitation data capabilities within the national health information architecture.

3.5. Implementation Process of Integration

The integration of the WHO RHIS-Rehabilitation module into Uganda's national HMIS followed a systematic, multi-phase approach spanning over two years from initial stakeholder engagement through active data collection ([Fig. 7](#)).

The process began with foundational stakeholder consultations among the MoH, WHO, and ReLAB-HS in October 2022, strategically leveraging Uganda's mid-term HMIS review to mainstream rehabilitation data within the national health information architecture. These consultative meetings established clear project objectives, roles, and responsibilities while securing critical buy-in from key government stakeholders and decision-makers. The timing proved advantageous, as the MoH was already exploring opportunities to enhance rehabilitation and assistive technology data collection within the DHIS2 platform during this review period.

A comprehensive indicator selection workshop held in February 2023 at Jinja district convened 43 diverse stakeholders, including rehabilitation professionals (physiotherapists, occupational therapists,

orthopedic technologists, audiologists), medical records specialists, HMIS officials, and representatives from the Disability and Rehabilitation Division. Over three days, participants systematically reviewed the WHO's 15 standard RHIS-Rehabilitation indicators, evaluating each based on specific criteria, including usefulness for decision-making at all health system levels, facilitation of comprehensive analysis across results chain domains, ease of standardization, relevance for regional and global reporting, availability of variables in facilities, and limited data collection burden. The workshop employed structured breakout sessions and plenary discussions to achieve consensus, ultimately agreeing to include 13 of the 15 WHO-proposed indicators and ranking them according to national priorities. However, following submission to the MoH HIS division for final review, budgetary constraints and competing sectoral priorities led to the removal of seven indicators, leaving six core rehabilitation indicators for integration into DHIS2. This reduction highlighted the complex negotiation processes inherent in health system strengthening initiatives and the importance of early engagement with high-level decision-makers to minimize indicator attrition during implementation.

In parallel with indicator selection, a comprehensive readiness assessment was conducted across 12 strategically selected facilities, including two National Referral Hospitals and 10 Regional Referral Hospitals, beginning in February 2022. The structured assessment employed WHO-developed checklists to evaluate human resources, rehabilitation service delivery capacity, data-reporting systems, information-use practices, and infrastructure availability. We have already presented some of the key findings in [Sections 3.2 and 3.3](#). These findings informed subsequent capacity-building interventions and highlighted the need for substantial technical support during implementation.

The technical development phase from April through November 2023 involved intensive collaboration among MoH, WHO, and ReLAB-HS to modify existing HMIS tools and develop new data-collection instruments. The most significant innovation was the development of an independent outpatient rehabilitation register (HMIS REH 002), under the MoH direction. Previously, rehabilitation data were recorded in the common outpatient registers without dedicated fields for rehabilitation-specific variables. HMIS REH 002 provided a purpose-built, facility-level source document for systematically capturing the five out of six core rehabilitation indicators (except coverage of acute and complex needs) selected for DHIS2 reporting, along with additional indicators (such as rehabilitation and assistive product waiting time) that are analyzed at the facility level but not reported to DHIS2. Following Uganda's standard HMIS information flow, these outpatient indicators captured in REH 002 are aggregated into the standard outpatient monthly reporting form (HMIS 105), transmitted to the district level, and entered into DHIS2. In this way, REH 002 functions as the foundational data-capture instrument within the existing HMIS reporting pipeline rather than as a standalone parallel system. For inpatient services, the existing inpatient register (HMIS IPD 003) was modified to include five of the six core rehabilitation indicators (excluding outreach program uptake) selected for DHIS2 reporting. HMIS IPD 003 also captured information on "Functioning Change" and "Individualized Care Plans" at facilities with dedicated rehabilitation wards, but these data are not yet reported to DHIS2, pending the future digitization of inpatient reporting systems.

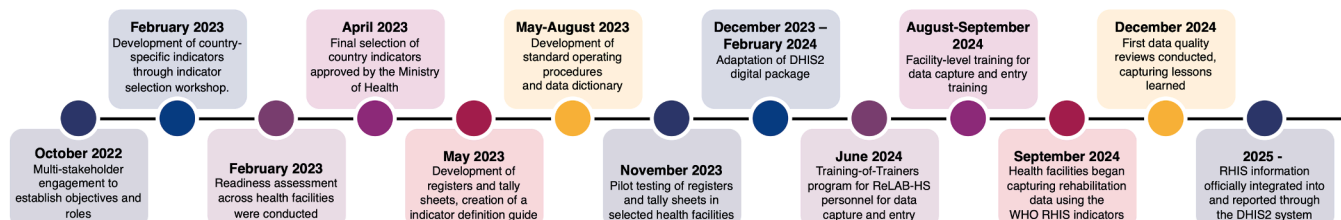


Fig. 7. Timeline of integrating the WHO Routine Health Information System - Rehabilitation module into Uganda's National Health Information System.

Thus, REH 002 addresses outpatient rehabilitation data capture, while the modified IPD 003 addresses inpatient data capture. Together, they form the complete facility-level documentation layer for the six DHIS2-reported indicators and the additional facility-level indicators.

During this process, comprehensive [supporting materials](#) were also produced in consultation with the WHO, including updated data dictionaries, detailed definition guides, standard operating procedures, and individual monthly reporting forms (HMIS 105 for outpatients, HMIS 108 for inpatients) used by HMIS focal persons for data entry. Pilot testing of revised tools across 18 health facilities (regional referral and district hospitals) in November 2023 enabled refinement based on user feedback (healthcare providers and HMIS focal persons) and real-world implementation challenges.

Platform customization and capacity building commenced in December 2023 when the MoH HIS Division, supported by the Health Information Systems Program (HISP), began DHIS2 modifications to accommodate the finalized rehabilitation indicators. This technical adaptation occurred within an integrated approach, as part of the mid-term review of HMIS, encompassing multiple health sectors rather than as a standalone rehabilitation module. Next, in collaboration with the WHO and the ReLAB-HS central team, a comprehensive Training-of-Trainers (ToT) program in June 2024 equipped MoH staff and ReLAB-HS technical advisors with the skills to conduct facility-level orientations. We also co-developed training materials that addressed anticipated implementation challenges through role-playing exercises and scenario-based discussions. The ToT program proved particularly valuable as it not only developed training materials but also involved extensive discussions anticipating the types of questions trainers would encounter. The ToT program involved role-playing and multiple scenarios that accounted for local context and geographical variability. This thorough preparation enabled trainers to resolve many issues during implementation because they were well equipped to address various challenges. Following the ToT, these trained facilitators conducted regional training sessions among more than 100 HMIS focal persons between August and September 2024, covering seven regions across Uganda's 15 sub-regions.

Data collection officially commenced in September 2024 across 25 facilities, including four National Referral Hospitals, 17 Regional Referral Hospitals, and three district hospitals, covering 15 sub-regions of Uganda. The implementation faced initial challenges, including the simultaneous introduction of digital platforms at the point of care, which created confusion among staff accustomed to paper-based systems. A delayed launch of the rehabilitation-specific DHIS2 data-entry module generated resistance among health workers, and sustainability concerns arose regarding register printing and distribution, which depended on donor support. Nonetheless, high levels of enthusiasm among rehabilitation professionals and hospital management provided a strong foundation for success, with one data analyst commenting that the new indicators addressed longstanding challenges in identifying performance measures for rehabilitation professionals. Continuous technical support through WhatsApp groups enabled real-time problem-solving and knowledge sharing among trained personnel, while planned quarterly data quality reviews, beginning in December 2024, ensured adherence to protocols and progressive improvement in data accuracy. Although full online reporting through DHIS2 is scheduled for 2025, facilities have begun systematic data capture and storage to facilitate retrospective data entry once the platform is fully operational.

4. Discussion

This study examined the integration of the WHO RHIS-Rehabilitation module into Uganda's national HMIS, documenting a comprehensive implementation process that successfully established standardized rehabilitation data collection across 25 health facilities. The integration achieved significant milestones, including the development of customized data-collection tools, the capacity building of more than 100 health

workers, and the establishment of a systematic rehabilitation data-capture system, which began in September 2024. During the integration process, multiple units within the MoH assumed distinct roles and provided critical leadership and decision-making. The Division of Disability and Rehabilitation served as the programmatic lead and championed the data system integration, including leading facility orientations and training teams. In parallel, the MoH HIS Division acted as the system owner and governance gatekeeper for DHIS2 integration, facilitating discussions during the indicator workshop, conducting the final review of the proposed indicator set, and leading the adaptation of the rehabilitation module. Ministry's HIS Division finally implemented technical configuration work for DHIS2 platform modifications with support from HISP.

The authors of this paper, affiliated with the Johns Hopkins Bloomberg School of Public Health and the WHO, directly provided technical and logistical support throughout the integration process as part of the ReLAB-HS project, including indicator adaptation, tool development, training design, facility-level implementation support, and data quality standards development. Given this embedded role, we employed a retrospective, theory-informed analytical approach using CFIR to critically examine the implementation process while maintaining awareness of our position as implementing partners. While the implementation partners, including WHO and ReLAB-HS, provided technical inputs and convening support throughout, facility-level rehabilitation managers, medical records staff, and HMIS focal persons shaped feasibility judgments during indicator selection and subsequent tool refinement.

The implementation process also revealed substantial challenges across multiple implementation domains, including indicator reduction stemming from competing health-sector priorities, infrastructure constraints, and workforce limitations. Our analysis identified critical success factors and barriers that provide actionable insights for similar health system strengthening initiatives in LMICs ([Table 2](#)).

The implementation process demonstrated the critical importance of strategic timing and government ownership in health system reforms. Leveraging Uganda's mid-term HMIS review created an opportune window for rehabilitation data integration, while strong MoH leadership proved instrumental in navigating bureaucratic challenges and maintaining implementation momentum. The reduction from 15 to 6 indicators during the MoH review process, while initially disappointing, highlighted the reality of resource constraints and competing health sector priorities that characterize many LMIC settings. This experience underscores the need for early engagement with high-level decision-makers and realistic expectation setting during the planning phase. The development of an independent outpatient rehabilitation register (HMIS REH 002), though innovative in elevating rehabilitation data visibility, also raised sustainability concerns regarding long-term funding for printing and distribution, which remained dependent on donor support.

Training and capacity building emerged as both a significant strength and an ongoing challenge throughout the implementation. The decision to conduct facility-based rather than centralized training proved highly effective in addressing real-world implementation challenges and fostering direct engagement with hospital management. This approach enabled trainers to provide contextualized support while advocating for additional institutional support from facility administrators. However, the decentralized training strategy also exposed infrastructure limitations, including inadequate training spaces, high patient volumes that disrupted sessions, and the complexity of managing simultaneous digital transformation initiatives at the point of care. The establishment of WhatsApp groups for ongoing technical support demonstrated the value of continuous engagement and real-time problem-solving, contributing to sustained data quality improvements and staff confidence in using the new systems.

The integration revealed fundamental structural challenges within Uganda's rehabilitation service delivery system that extend beyond data collection to core service availability and workforce capacity. The

Table 2

Implementation challenges and opportunities across CFIR Domains for integrating the WHO Routine Health Information System - Rehabilitation module within Uganda's DHIS2.

Implementation Domains	Challenges	Opportunities
Legacy HMIS & Implementing Actors (adapted for the "Individuals" domain) <i>refers to the legacy HMIS of Uganda (its pre-existing data collection architecture, tools, and protocols) and implementation stakeholders (MoH officials, rehabilitation professionals, data managers, healthcare workers). It considers stakeholder knowledge, skills, attitudes, and capacity-building roles in adopting the RHIS-Rehabilitation module, recognizing how legacy system constraints interact with stakeholder competencies to shape implementation success</i>	- Staff rotation/turnover among HMIS focal persons and rehabilitation leads weakened continuity, institutional memory, and adherence to revised reporting responsibilities - Rehabilitation professionals faced confusion during the transition to the new indicator set due to a lack of communication from the MoH. - Staff shortages in facilities hindered consistent data collection and reporting. - Resistance to adopting new processes due to busy schedules and high patient workloads.	- Embedding rehabilitation indicators into the HMIS increases perceived relevance and sustained use data for decision making - Motivated staff (e.g., rehabilitation professionals, HMIS focal persons, and facility in-charges) viewed the new indicators as solutions for performance measurement. - Legacy system's data gaps created an opening to embed RHIS-Rehabilitation training into physiotherapy, occupational therapy, and other rehabilitation professional curricula, ensuring that newly qualified professionals enter the workforce with native competence in standardized rehabilitation data collection.
Inner Setting <i>focuses on Uganda's rehabilitation service delivery system, including referral hospitals and district facilities. It examines infrastructure, organizational culture, workflows, workforce capacity, internet connectivity, and the new module's compatibility with existing DHIS2 indicators and processes.</i>	- The existing DHIS2 system lacked a dedicated set of rehabilitation indicators, limiting the capture of rehabilitation data. - Inconsistent reporting practices and data quality issues, such as missing data and outliers, were prevalent. - Lack of rehabilitation-specific services and providers at primary healthcare levels restricted data collection. - High patient loads disrupted training sessions and data collection processes in health facilities. - Limited infrastructure, such as space, computers, and internet access, hindered effective training and data collection. - Competing priorities, such as TB and HIV, limited the space available for new rehabilitation indicators.	- On-site training enabled hands-on learning and allowed trainers to address real-world challenges. - Enthusiasm among rehabilitation professionals and data personnel ensured commitment to the new system. - Facility-level engagement supported advocacy for rehabilitation services and improved local ownership. - Digital transformation offered opportunities for streamlining data collection and improving data timeliness.
Outer Setting <i>encompasses the broader context influencing Uganda's HMIS, including national policies, socioeconomic factors, donor influences, and international guidelines. It reflects how external pressures, the Ministry of Health, WHO, and partners shape rehabilitation data integration into DHIS2.</i>	- Policy barriers delayed the integration of rehabilitation data into broader health information systems. - Limited government funding for printing and distributing registers hindered sustainability. - Fragmentation of rehabilitation and assistive technology data systems across different sectors (e.g., humanitarian settings, healthcare financing)	- Leveraging the Ministry of Health's mid-term review of HMIS facilitated integration into national priorities. - Existing policies, like the Disability Act 2020, support building an enabling environment that ensures the inclusion of rehabilitation data into HMIS. - Cross-sector partnerships provided avenues to improve rehabilitation service delivery. - Increased advocacy for rehabilitation services elevated its status within national health policies. - The WHO RHIS - Rehabilitation module's standardized indicators enhanced data-driven decision-making and service monitoring.
Innovation <i>refers to the characteristics of the RHIS - Rehabilitation module itself, including its features, structure, and purpose, which aims to standardize data collection on rehabilitation services and assistive technology within the DHIS2 system.</i>	Limited provision of rehabilitation services within routine primary care service constrains the current scope of RHIS-Rehabilitation indicators, which are predominantly configured for referral-level facilities; although the ReLAB-HS project introduced basic rehabilitation care into selected primary care settings, broader integration of rehabilitation into standard primary healthcare packages would be a prerequisite for full indicator adoption at this level.	- Minimum adaptations to the RHIS - Rehabilitation module facilitated easier alignment with Uganda's health system. - Integrating rehabilitation data into digital platforms increased the visibility and importance of rehabilitation services. - The module's flexibility allowed future expansion to include more detailed indicators and service categories. - Collaboration with the Ministry of Health and WHO facilitated smooth navigation through the integration process.
Implementation Process <i>covers activities and strategies for integrating the RHIS - Rehabilitation Module into DHIS2, including stakeholder engagement, readiness assessments, indicator selection, tool development, and training. It emphasizes planning, execution, continuous support, feedback, and monitoring for sustainable implementation.</i>	- Some indicators were removed during the Ministry of Health's review due to budget constraints and priorities. - Developing independent outpatient rehabilitation registers raised concerns about long-term funding and sustainability. - Sustained funding was needed for printing registers, which relied on donor support. - Decentralized training faced logistical issues due to limited space and high patient volumes in facilities. - Initial feedback from the facilities revealed variations in reporting practices and inconsistencies in data capture.	- Development of a detailed definition guide, standardized data interpretation, and enhanced reporting consistency. - Role-playing and scenario-based training prepared trainers to address common challenges effectively. - Training at health facilities provided direct engagement with hospital management, providing additional support. - Continuous technical support, including quarterly data quality reviews, improved data accuracy and adherence. - Establishing a WhatsApp group enabled real-time support and knowledge-sharing among trained staff.

concentration of rehabilitation services primarily at referral hospital levels, combined with critical workforce gaps, particularly in speech therapy, audiology, and specialized medical rehabilitation, limited the potential scope of data collection to higher-tier facilities. This structural reality meant that the WHO RHIS module could not be implemented at primary healthcare levels where rehabilitation-specific providers are absent, representing a significant limitation for comprehensive health system coverage. Nevertheless, the enthusiasm demonstrated by

rehabilitation professionals and hospital management, exemplified by one data staffer's comment that "we have been struggling to identify performance indicators for rehabilitation professionals; these indicators have solved our problem," suggests strong organizational readiness for systematic performance measurement and quality improvement initiatives.

This study employed a comprehensive case study methodology that triangulated multiple data sources, including organizational reports,

rapid readiness assessments, national household surveys, and policy documents, to provide detailed insights into implementation. While this approach may lack the quantitative rigor, it offers robust triangulation and captures the complex, contextual factors that influence health system interventions in real-world settings. A significant limitation was our inability to report comprehensive data quality assessment results due to premature funding withdrawal from the donor organization, which prevented systematic evaluation of data accuracy and completeness across participating facilities. However, this constraint paradoxically provided valuable insights into the sustainability challenges facing health system strengthening initiatives in donor-dependent environments, highlighting the critical importance of securing long-term financial commitments for successful implementation and evaluation of complex health information system reforms.

The application of an implementation science framework, specifically the CFIR, enabled systematic identification and categorization of barriers and facilitators across multiple domains, providing structured insights that enhanced both our understanding of complex implementation dynamics and the generalizability of findings. However, several limitations warrant discussion. CFIR was originally designed for implementing clinical interventions (e.g., new practices or medications) (Damschroder et al., 2009). Applying it to digital data system integration required reconceptualizing the Individuals Domain as the Legacy HMIS System rather than individual adopters, or any specific health systems stakeholder. This adaptation, while we believe methodologically justified, means some CFIR constructs, particularly individual-level factors such as personal adopter characteristics and motivation, are less granularly captured than the framework typically allows. Secondly, while CFIR excels at identifying implementation determinants and barriers, it has a relative weakness in decomposing power and political dynamics. These dynamics were a major factor that led to the final selection of six indicators instead of all 15, but we were unable to fully capture the political determinants within the framework's domains.

Finally, our case design was appropriate as Uganda's experience represented a unique, information-rich case of systematic integration of rehabilitation data into a national HMIS, providing insights that could inform similar initiatives in other LMICs seeking to strengthen health information systems for previously neglected health services. However, several context-specific factors may limit the direct application of the WHO RHIS-Rehabilitation module to other settings. Uganda's relatively mature DHIS2 platform infrastructure, operational since 2011–12 for other health programs, proactive technical support from the ReLAB-HS project, strong government ownership, and established rehabilitation professional networks may not be replicated in countries with weaker digital health platforms, limited donor engagement, or fragmented health systems. However, the process insights from our activities, which included a phased implementation approach, assessing systems readiness, stakeholder-driven indicator selection, facility-based training, and continued technical support, appear potentially transferable to similar LMIC contexts with comparable health system structures and DHIS2 platforms.

5. Conclusion

The integration of the WHO RHIS - Rehabilitation module into Uganda's National HMIS signifies a milestone in strengthening rehabilitation data collection and management. By examining Uganda's experience integrating this module into the national DHIS2 platform, this case study contributes an implementing-country perspective on how a WHO RHIS package is adapted, negotiated, and operationalized within routine health information systems in resource-limited settings, and on the implementation strategies needed for neglected service areas such as rehabilitation. Rather than presenting as a seamless adoption, our experience demonstrates that effective implementation requires deliberate and adaptive tinkering for a phased approach for indicator selection guided by health systems capacity rather than global guidance

templates; facility-based, multi-day onsite training delivered by local rehabilitation professionals rather than centralized workshops; and sustained and contextualized technical support for each professional cadre rather than generic SOP approaches. Key implementation decisions, including the development of facility-owned outpatient rehabilitation registers and the establishment of facility-level HMIS focal persons to maintain data quality, may address infrastructure and workforce constraints that emerged during readiness assessments. However, success depended not on removing barriers (e.g., infrastructure gaps, staffing shortages, etc.) but on designing implementation strategies that could work despite these constraints. For countries pursuing similar health information system strengthening in comparable contexts, our experience underscores that the WHO RHIS - Rehabilitation module requires substantial upfront stakeholder mapping to identify decision-makers, transparent negotiation, capacity-building tailored to cadres and facility levels, and ongoing technical support embedded in local communication channels. Sustainable rehabilitation data systems in LMICs demand pragmatic, iterative implementation rather than standardized rollout approaches.

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Ethical Approval

This study (IRB No. 00014471) received ethical approval from the Johns Hopkins School of Public Health (JHSPH) Institutional Review Board

CRediT authorship contribution statement

Gerald Okello: Writing – review & editing, Validation, Supervision, Project administration, Investigation, Data curation, Conceptualization. **Md Zabir Hasan:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Methodology, Formal analysis, Conceptualization. **Abraham Omaren:** Writing – review & editing, Supervision, Project administration, Investigation, Data curation. **Wouter De Groote:** Writing – review & editing, Supervision, Resources, Methodology, Conceptualization. **Abdulgafoor M Bachani:** Writing – review & editing, Supervision, Resources, Investigation, Funding acquisition, Conceptualization. **Adair Timothy:** Writing – review & editing, Supervision, Investigation, Data curation, Conceptualization.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the author(s) used Grammarly exclusively for identifying and correcting grammatical errors. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article

Declaration of Competing Interest

The authors declare that they have no conflicts of interest, financial or personal, that could have influenced the work reported in this paper.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the

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References

- About DHIS2 [Internet]. DHIS2. 2025 [cited 2025 Dec 22]. Available from: (<https://dhis2.org/about-2/>).
- Adair T., Hasan M.Z., Gerald Okello. Integrating Rehabilitation Data Into Uganda's Health Management Information System: A Promising Step Toward Improving Health Outcomes [Internet]. 2024 [cited 2025 Aug 27]. Available from: (<https://publichealth.jhu.edu/international-injury-research-unit/2024/integrating-rehabilitation-data-into-ugandas-health-management-information-system-a-promising-step-toward-improving-health-outcomes/>).
- Byrne, E., Sæbø, J.I., 2022. Routine use of DHIS2 data: a scoping review. *BMC Health Serv. Res.* 22 (1), 1234. Oct 6.
- Cieza, A., Causey, K., Kamenov, K., Hanson, S.W., Chatterji, S., Vos, T., 2021. Global estimates of the need for rehabilitation based on the Global Burden of Disease study 2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet Lond. Engl.* 396 (10267), 2006–2017. Dec 19.
- Creswell, J.W., Clark, V.L.P., 2018. Designing and conducting mixed methods research [Internet], 3rd ed. SAGE Publications. cited 2014 Aug 5]. Available from: (<http://us.sagepub.com/en-us/nam/designing-and-conducting-mixed-methods-research/book241842>).
- Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A., Sheikh, A., 2011. The case study approach. *BMC Med. Res. Methodol.* 11 (1), 100. June 27.
- Damschroder, L.J., Aron, D.C., Keith, R.E., Kirsh, S.R., Alexander, J.A., Lowery, J.C., 2009. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implement. Sci.* 4, 50. Aug 7.
- Damschroder, L.J., Reardon, C.M., Widerquist, M.A.O., Lowery, J., 2022. The updated Consolidated Framework for Implementation Research based on user feedback. *Implement. Sci.* 17 (1), 75. Oct 29.
- Degaga, S.D., Yesuf, S.S., Aweke, G.T., 2025. Implementation of the electronic community health information system in rural East Shewa zone, Eastern Ethiopia: a CFIR-ERIC framework for facilitators, barriers and implementation strategies. *Front. Digit. Health [Internet]* 7. (<https://www.frontiersin.org/journals/digital-health/articles/10.3389/fdgh.2025.1554995/full>). July 7 [cited 2025 Aug 27].
- Ghaffar, A., Bachani, A.M., Hyder, A.A., Cieza, A., Bhangu, A., Bussi eres, A., et al., 2024. Role and promise of health policy and systems research in integrating rehabilitation into the health systems. *Health Res. Policy Syst.* 22, 143. Oct 9.
- Gimbel, S., Mwanza, M., Nisingizwe, M.P., Michel, C., Hirschhorn, L., Hingora, A., et al., 2017. Improving data quality across 3 sub-Saharan African countries using the Consolidated Framework for Implementation Research (CFIR): results from the African Health Initiative. *BMC Health Serv. Res.* 17 (3), 828. Dec 21.
- Global Health Data Methods, 2025. Health management information systems [Internet]. *Glob. Health Data Methods* cited 2025 Dec 22]. Available from: (<https://globalhealthdata.org/health-management-information-systems/>).
- Hailemariam, T., Atnafu, A., Gezie, L.D., Kaasb  ll, J.J., Klein, J., Tilahun, B., 2023. Individual and contextual level enablers and barriers determining electronic community health information system implementation in northwest Ethiopia. *BMC Health Serv. Res.* 23 (1), 644. June 16.
- Kiberu, V.M., Matovu, J.K., Makumbi, F., Kyoziira, C., Mukooyo, E., Wanyenze, R.K., 2014. Strengthening district-based health reporting through the district health management information software system: the Ugandan experience. *BMC Med. Inform. Decis. Mak.* 14 (1), 40. May 13.
- Kirk, M.A., Kelley, C., Yankey, N., Birken, S.A., Abadie, B., Damschroder, L., 2016. A systematic review of the use of the Consolidated Framework for Implementation Research. *Implement. Sci.* 11, 72. May 17.
- Learning, Acting, and Building for Rehabilitation in Health Systems (ReLAB-HS), 2024. Rehabilitation in Uganda: A Call to Action [Internet]. Baltimore. Johns Hopkins Bloomberg School of Public Health, MD, USA. (https://relabhs.org/wp-content/uploads/2023/12/Policy-brief_policy-prioritization-Uganda-Final-1.pdf) [cited 2025 Jan 6]. Available from.
- Ministry of Health, Uganda (MoH), United States Agency for International Development (USAID), Learning, Acting, and Building for Rehabilitation in Health Systems (ReLAB-HS). Uganda rapid Assistive Technology Assessment [Internet]. Kampala, Uganda: MoH and ReLAB-HS; 2023 [cited 2025 Jan 6]. Available from: (<https://library.health.go.ug/sites/default/files/resources/Uganda%20rapid%20Assistive%20Technology%20Assessment%20Booklet%20V.3-2%20Final.pdf>).
- Ministry of Health, Uganda (MoH), 2023. Learning, Acting, and Building for Rehabilitation in Health Systems (ReLAB-HS). Systematic Assessment of Rehabilitation Situation (STARS) in Uganda [Internet]. Kampala, Uganda: Ministry of Health, Uganda (MoH). World Health Organization. (<https://library.health.go.ug/sites/default/files/resources/UGANDA%20STARS%20REPORT%202023.pdf>) [cited 2025 Jan 10]. Available from.
- Nuwasiima, S., Mpimbaza, A., Muteebwa, L., Nagawa, E., Arinaitwe, E., Kiberu, F., et al., 2025. Concordance of data on key malaria indicators between DHIS2 and source documents, and influencing factors at public primary health facilities in eastern Uganda: a mixed methods study. *Malar. J.* 24 (1), 270. Aug 20.
- Poppe, O., S  b  , J.I., Braa, J., 2021. WHO digital health packages for disseminating data standards and data use practices. *Int. J. Med. Inf.* 149, 104422 (May).
- Umezuruike C., Nwankwo W. Implementation Challenges Of Health Management Information Systems In Uganda: A Review. 2017;4(7).
- World Health Organization, 2019. Rehabilitation in health systems: guide for action [Internet]. World Health Organization, Geneva cited 2025 Jan 6]. Available from: (<https://iris.who.int/handle/10665/325607>).
- World Health Organization, 2022. Guidance on the Analysis and Use of Routine Health Information Systems: Rehabilitation Module [Internet]. World Health Organization, Geneva, Switzerland. Available from: (<https://iris.who.int/bitstream/handle/10665/354390/9789240050242-eng.pdf?sequence=1>).
- World Health Organization, 2023. Rehabilitation 2030: meeting report. World Health Organization, Geneva, Switzerland. July [cited 2025 Jan 6]. Available from: (<https://iris.who.int/bitstream/handle/10665/376162/9789240087392-eng.pdf?sequence=1>).
- World Health Organization, 2024c. Improving rehabilitation data in Uganda [Internet]. World Health Organization cited 2025 Jan 6]. Available from: (<https://www.who.int/news-room/feature-stories/detail/improving-rehabilitation-data-in-uganda>).
- World Health Organization. Routine health information systems – rehabilitation toolkit [Internet]. 2024a [cited 2025 Jan 6]. Available from: (<https://www.who.int/tools/routine-health-information-systems---rehabilitation-toolkit>).
- World Health Organization. Routine health information systems – rehabilitation toolkit – information sheet [Internet]. 2024b [cited 2025 Feb 5]. Available from: (<https://www.who.int/publications/m/item/routine-health-information-systems-rehabilitation-toolkit-information-sheet>).
- World Health Organization, 2025a. WHO Toolkit for Routine Health Information Systems Data. World Health Organization. Available from: (<https://www.who.int/data/data-collection-tools/health-service-data/toolkit-for-routine-health-information-system-data/modules>).
- World Health Organization, 2025b. Toolkit for Routine Health Information Systems data. World Health Organization. Available from: (<https://www.who.int/data/data-collection-tools/health-service-data/toolkit-for-routine-health-information-system-data/introduction>).
- Yin R.K. Case study research and applications: design and methods [Internet]. Thousand Oaks, California; 2018 [cited 2021 Mar 4]. 319 pages. Available from: (<https://us.sagepub.com/en-us/nam/case-study-research-and-applications/book250150>).
- Zerfu, T.A., Assresie, M., Begna, Z., Habtamu, T., Werkneh, N., Nigatu, T., et al., 2024. Unveiling the role of DHIS2 in enhancing data quality and accessibility in primary healthcare facilities: Evidence from Ethiopia. *PLOS ONE* 19 (12), e0314505. Dec 18.

Glossary

- Assistive Technology (AT):** Devices or products—such as wheelchairs, hearing aids, or prosthetics—that enhance an individual's ability to function and participate in daily activities.
- Consolidated Framework for Implementation Research (CFIR):** A multi-domain implementation science framework that structures analysis of contexts, processes, and determinants influencing health system interventions.
- Data Dictionary:** A reference document defining each data field, indicator, and reporting variable used within HMIS and associated registers.
- DHIS2 (District Health Information System 2):** An open-source digital platform used for health data management and reporting at national and subnational levels; serves as Uganda's backbone for electronic HMIS.
- Health Management Information System (HMIS):** An integrated system for routine collection, processing, and reporting of health service data at facility and national levels, used for planning, monitoring, and management.
- Implementation Science:** The interdisciplinary study of methods to promote the systematic uptake of research findings and evidence-based practices into regular use by health systems.
- Rapid Readiness Assessment:** A structured evaluation conducted prior to implementation to assess health facility infrastructure, workforce capacity, and digital preparedness for new systems.
- Rehabilitation:** A set of interventions designed to optimize functioning and reduce disability in individuals with health conditions, including both medical and community-based services.
- Standard Operating Procedures (SOPs):** Documented, step-by-step instructions to ensure standardized processes in data collection, entry, and reporting within facility and national systems.
- Universal Health Coverage (UHC):** A health system goal to provide all individuals access to essential health services—including rehabilitation—without financial hardship.
- WHO RHIS-Rehabilitation Module:** A standardized data collection and reporting toolkit developed by the World Health Organization for integrating rehabilitation indicators into national health information systems, including DHIS2.