Comparative Review of the WHO Immunization Digital Adaptation Kit (DAK) and Localized DAKs in Ghana, Malawi, and Tanzania

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Abstract

Background: Digital Adaptation Kits (DAKs) are increasingly used to standardize and accelerate the implementation of digital health interventions. The World Health Organization (WHO) released the Immunization DAK in 2025 to provide operational requirements for digital immunization systems[1]. However, countries often need to localize these global standards to fit national policies, workflows, and digital health maturity.

Objective: This comparative review compares the finalized WHO Immunization DAK with localized DAKs developed for Ghana, Malawi, and Tanzania, highlighting areas of alignment, divergence, and lessons for digital health adaptation.

Methods: We conducted a comparative analysis across eight DAK components—user personas, user scenarios, business processes, data elements, decision support, indicators, requirements, and non-functional requirements—using standardized definitions and tabular synthesis.

Results: Strong alignment was observed across most components, particularly in user personas, core workflows, and indicators. Divergences reflected necessary local adaptations, especially in data elements, decision support, and non-functional requirements. The process of localization led to context-specific extensions, such as vaccine stock management and newborn registration.

Conclusion: Comparative reviews of global and localized DAKs are essential for ensuring digital health systems remain both interoperable and context-appropriate. Our findings offer practical guidance for countries seeking to adapt global digital health standards to local realities

1. Introduction

Digital Adaptation Kits (DAKs) are a cornerstone of the WHO's strategy to accelerate the adoption of digital health interventions by providing machine-readable, standards-based operational requirements. The Immunization DAK, published in January 2025, aims to guide countries in implementing digital immunization systems that are aligned with global best practices while remaining adaptable to local needs.

However, the process of localization - adapting global standards to fit national policies, workflows, and digital health maturity - remains a critical challenge. The Digital Innovation and Pandemic Control (DIPC) project, a partnership between GIZ, Digital Square at PATH, and ministries of health in Ghana, Malawi, and Tanzania, sought to address this challenge by developing localized DAKs for immunization in each country. This paper presents a comparative review of the WHO Immunization DAK and the localized DAKs for Ghana, Malawi, and Tanzania. Our goal is to identify key areas of alignment and divergence, and to draw lessons for the design and implementation of digital health systems in diverse contexts.

[1]WHO. Digital adaptation kit for immunizations: operational requirements for implementing WHO recommendations in digital systems. Geneva: World Health Organization; 2024 (SMART Guidelines collection).

2. Methods

Study Design

We conducted a descriptive, comparative analysis of the WHO Immunization DAK (2025) and the localized DAKs developed under the DIPC project for Ghana, Malawi, and Tanzania.

Data Sources

- WHO Immunization DAK (2025)
- Localized DAKs for Ghana, Malawi, and Tanzania
- Comparative review tables and worksheets developed by the DIPC project

Analytical Framework

Eight main DAK components were systematically compared:

1. User personas
2. User scenarios
3. Business processes and workflows
4. Data elements
5. Decision support
6. Indicators and performance metrics
7. Requirements
8. Non-functional requirements

Standardized definitions were used to assess alignment: “aligns,” “differs slightly,” “varies,” and “extends” as follows.

- **Aligns:** The country DAK matches the WHO DAK exactly or with only negligible differences in wording that do not alter meaning or intent. The high-level requirement or workflow is essentially identical.

- **Differs slightly:** The country DAK includes slight modifications from the WHO DAK—such as small adjustments in terminology, examples, or processes that reflect the local context—while maintaining the same overall meaning, intent, and scope. Example: The country’s vaccination schedule reflects its official immunization calendar and is therefore a subset of the broader WHO schedule, which encompasses all global recommendations. For example, all three DIPC project countries (i.e., GH, MW, TZ) exclude Japanese Encephalitis, which is included in the WHO DAK, because these diseases are not a significant public health concern in sub-Saharan Africa and are therefore not part of their national vaccination schedules.

- **Varies:** The country DAK diverges from the WHO DAK in ways that alter the described process, requirements, or personas. These differences may include adding or removing steps, redefining roles, or omitting elements that are either addressed elsewhere or already managed by the country’s existing digital health information system and is not specific only to immunization. Example: In the WHO DAK, the System Administrator persona includes tasks such as system configuration. For example, in the Ghana DAK, this persona is not listed, but the related requirements, such as “GIZPS.FXNREQ.180 Configure adverse reaction type” is still covered. Similarly, the WHO DAK includes the step “Register a vaccination location,” which is omitted in the Malawi DAK because location setup is already managed in another module (i.e., not the immunization module) of the existing digital health information system and is therefore out of scope of the localized DAK for immunization.

- **Extends:** The country DAK adds additional content, requirements, or workflows beyond what is in the WHO version. These extensions reflect local policy and context-specific needs. The country DAKs introduces vaccine stock management functionality, adding new personas, processes, and requirements to support the ordering, tracking, and reporting of vaccine supplies.

Quantitative alignment percentages and qualitative narrative synthesis were used to summarize findings.

3. Results

3.1 Alignment and Divergence Across DAK Components

User Personas

User personas are archetypal representations of the different types of users who interact with a digital immunization system, capturing their roles, needs, and behaviors to inform system design and requirements. All three countries' DAKs align with the WHO DAK on core user personas such as health workers (e.g., midwife, Disease Control Officer), community health workers, EPI managers, caregivers, and clients. Ghana and Tanzania extend the personas to include roles like Deputy Director Public Health and Health Information Officer, reflecting local organizational structures. Gaps remain in the explicit documentation of system administrators and clerical staff in some countries.

Table 1 shows a summary of the results of the WHO DAK as compared to the countries' DAKs across component 1.

Table 1: Component 1: Alignment with user personas.

1. User personas	Ghana	Malawi	Tanzania
Health worker	Aligns	Aligns	Aligns
Community health worker	Aligns	Aligns	Aligns
EPI Manager	Aligns	Aligns	Aligns
Caregiver	Aligns	Aligns	Aligns
Client	Aligns	Aligns	Aligns
Child	Variation	Gap	Aligns
System Administrator	Gap	Gap	Gap
Clerical Staff	Gap	Aligns	Aligns
Immunization Officer	Extends	Extends	Extends
Vaccine Logistics Officer	Extends	Extends	Extends
Deputy Director Public Health	Extends	-	-
Health information officer	Extends	-	-
Mother Care Groups (MCG)	-	Extends	-

A dash "—" indicates that the persona was not applicable or not included in the respective country's DAK.

	5/8	6/8	7/8
Aligns	63%	75%	88%

User Scenarios

User scenarios are structured descriptions of typical tasks or activities that different users perform within a digital immunization system, illustrating how the system should support real-world workflows and interactions. Ghana and Tanzania fully align with the WHO DAK's three core user scenarios: conducting routine immunizations, tracing defaulters, and conducting immunization campaigns. Malawi's DAK covers the underlying functionality but does not explicitly document the "routine vaccination at a clinic" scenario, indicating an area where the documentation could be expanded or a new scenario could be added in future iterations.

Table 2: Component 2: Alignment with user scenarios				
2. User scenarios	**WHO DAK v1.0.0**	**Ghana**	**Malawi**	**Tanzania**
Conduct routine vaccination at a clinic (Caregiver, child, health worker)	Generic benchmark	Aligns	Gap	Aligns
Trace a defaulter (health worker, CHW)	Generic benchmark	Aligns	Aligns	Aligns
Conduct a periodic intensification of routine immunization campaign (catch-up campaign) (District EPI Manager)	Generic benchmark	Aligns	Aligns	Aligns
		3	2	33
	Aligns	100%	67%	100%

Business Processes and Workflows

Business processes are the structured sets of activities or tasks that collectively achieve a specific organizational goal, while workflows describe the sequence and flow of these tasks, including how information and responsibilities move between users or systems. Most core workflows—such as registering clients, planning service delivery, administering vaccines, and tracing defaulters—are well aligned. All three countries extend the WHO DAK by incorporating workflows for vaccine stock management and, in Ghana and Tanzania, newborn registration. These extensions reflect local priorities and health system realities.

Table 3: Component 3: Alignment with business processes and workflows.				
3. Business process and workflows	**WHO DAK v1.0.0**	**Ghana**	**Malawi**	**Tanzania**
Register a vaccination location	Generic benchmark	Aligns	Gap	Aligns
Plan service delivery	Generic benchmark	Aligns	Aligns	Aligns
Register a client	Generic benchmark	Aligns	Aligns	Aligns
Administer vaccine(s)	Generic benchmark	Aligns	Aligns	Aligns
Remind a client	Generic benchmark	Aligns	Aligns	Aligns
Trace defaulters	Generic benchmark	Aligns	Aligns	Aligns
Resolve duplicate client records	Generic benchmark	Aligns	Aligns	Aligns
Resolve duplicate vaccination events	Generic benchmark	Aligns	Aligns	Aligns
Generate a report	Generic benchmark	Aligns	Aligns	Aligns
Create a newborn record	Not included	Extends		Extends
Manage arrivals of vaccine and related supplies (stock)	Not included	Extends	Extends	Extends
Distribute supplies to region/district	Not included	Extends	Extends	
Distribute supplies to health center	Not included	Extends	Extends	
Manage vaccine inventory	Not included	Extends	Extends	Extends
Manage cold chain inventory	Not included	Extends		Extends
		9	8	9
	Aligns	100%	89%	100%

Data Elements

Data elements are the individual units of information—such as fields, variables, or attributes—that are collected, stored, and exchanged within a digital immunization system to support workflows, reporting, and decision-making. Alignment is strong for client registration data elements, but differences emerge in vaccine administration, reporting, and the vaccine library. The localized DAKs derive data elements directly from country-specific registers and forms, differing from the standardized WHO approach, which - by its very nature- is broad and all-encompassing. For example, the structure and format of data elements will reflect existing national health information systems, such as DHIS2 or electronic medical record systems, or paper forms and registers already in use. Countries may record additional fields (e.g., for vaccine administration, additional fields may include location codes and vaccine batch tracking) and customize reporting outputs to meet national indicators or donor reporting requirements. These minor differences are expected and reflect necessary localization to ensure practicality, interoperability, and alignment with national health priorities and systems. The localized DAKs also include data elements for workflows that are not included within the WHO DAK, primarily the 'manage vaccine stock' workflow. Despite these differences, the WHO DAK remains a valuable benchmark for comparison, helping countries assess alignment with global standards and identify areas where local adaptations are needed.

Table 4: Component 4: Alignment with core data elements

4. Core data elements	WHO DAK v1.0.0	Ghana	Malawi	Tanzania
IMMZ.C Register a client	Generic benchmark	Aligns	Aligns	Aligns
IMMZ.D Administer vaccine	Generic benchmark	Differs slightly	Differs slightly	Differs slightly
IMMZ.I Generate a report	Generic benchmark	Differs slightly	Differs slightly	Differs slightly
IMMZ.Z Vaccine library	Generic benchmark	Differs slightly	Differs slightly	Differs slightly
		1	1	1
Aligns		25%	25%	25%

Decision Support

Decision support refers to the set of automated rules, logic, and tools within a digital immunization system that guide users - such as health workers - on appropriate actions, such as when and which vaccines to administer, based on clinical guidelines and patient data. National vaccination schedules in the localized DAKs are broadly aligned with the WHO DAK for routine childhood immunizations. The decision support in the localized DAKs reflects the national vaccination schedules as defined by the respective ministries of health in each of the three countries. These schedules are broadly aligned across the countries for routine childhood vaccinations from birth to six months, with some divergence beyond seven months to accommodate country-specific priorities. Notably, Ghana and Malawi have incorporated the new malaria vaccine, whereas Tanzania has not. Divergence also occurs for vaccines not prioritized nationally (e.g., rabies, dengue), which are included in the WHO DAK but not in the localized DAKs, as these are not among the priority vaccines in the respective countries. The WHO DAK provides - as expected - a more comprehensive and globally oriented framework, including vaccines such as rabies and dengue, and offers more detailed documentation of scheduling and decision support logic for each vaccine. This comprehensive approach serves as a valuable reference point, even as localized DAKs tailor decision support to reflect national guidelines and implementation realities.

Table 5: Component 5: Alignment with the WHO decision support logic for scheduling				
5. Decision support logic (vaccination schedules)	**WHO DAK v1.0.0**	**Ghana**	**Malawi**	**Tanzania**
BCG	Generic benchmark	Included	Included	Included
OPV	Generic benchmark	Included	Included	Included
DPT-Hep B – Hib1	Generic benchmark	Included	Included	Included
Pneumococcal 1	Generic benchmark	Included	Included	Included
Rotavirus 1	Generic benchmark	Included	Included	Included
Measles Rubella	Generic benchmark	Included	Included	Included
Malaria	Generic benchmark	Included	Included	Included
HPV	Generic benchmark	Included	Included	Included
Typhoid	Generic benchmark	Not included	Not included	Not included
Japanese encephalitis	Generic benchmark	Not included	Not included	Not included
Yellow fever	Generic benchmark	Included	Not included	Not included
Tick-borne encephalitis (TBE)	Generic benchmark	Not included	Not included	Not included
Cholera	Generic benchmark	Not included	Not included	Not included
Meningoccal	Generic benchmark	Included	Not included	Not included
Hepatitus A	Generic benchmark	Not included	Not included	Not included
Dengue	Generic benchmark	Not included	Not included	Not included
Rabies	Generic benchmark	Not included	Not included	Not included
Seasonal influenza	Generic benchmark	Not included	Not included	Not included
Varicella	Generic benchmark	Not included	Not included	Not included
		10	8	8
	Included	53%	42%	42%

Indicators and Performance Metrics

Indicators and performance metrics are standardized measures used to assess the performance, quality, and outcomes of immunization programs. They help track progress, identify gaps, and inform decision-making at both national and global levels. All three countries' DAKs are fully aligned with the four core WHO immunization indicators: (1) immunization coverage for measles and rubella-containing vaccine, 1st dose; (2) immunization coverage for measles and rubella-containing vaccine, 2nd dose; (3) dropout rate from the 1st dose of measles and rubella-containing vaccine to the 2nd dose; and (4) availability of vaccine stock and supplies by vaccination location. Localized DAKs include additional, country-specific indicators to support national monitoring and reporting needs. Notably, these include more detailed metrics such as those related to adverse events following immunization monitoring, which are critical for ensuring vaccine safety and maintaining public trust in immunization programs.

Table 6: Component 6: Alignment with the four core WHO Immunization indicators				
6. Indicators and performance metrics	**WHO DAK v1.0.0**	**Ghana**	**Malawi**	**Tanzania**
IMMZ.IND.12 Immunization coverage for measles and rubella-containing vaccine, 1st dose	Generic benchmark	Aligns	Aligns	Aligns
IMMZ.IND.13 Immunization coverage for measles and rubella-containing vaccine, 2nd dose	Generic benchmark	Aligns	Aligns	Aligns
IMMZ.IND.37 Drop out rate from the 1st dose of measles and rubella-containing vaccine to the 2nd dose	Generic benchmark	Aligns	Aligns	Aligns
IMMZ.IND.42 Availability of vaccine stock and supplies (by vaccination location)	Generic benchmark	Aligns	Aligns	Aligns
		3	3	3
	Align	100%	100%	100%

Functional Requirements

Core functional requirements—which define the essential capabilities, processes, and behaviors that a digital immunization system must support to meet user and program needs—are consistent across the WHO and localized DAKs, particularly for foundational workflows. All localized DAKs also add additional requirements by workflows such as 'manage arrivals of vaccine and related supplies.' Tanzania's DAK shows more divergence in advanced tasks, reflecting adaptation to local context and reporting needs.

Table 7: Component 7: Alignment with functional requirements				
7. Functional requirements by business process / workflow	**WHO DAK v1.0.0**	**Ghana**	**Malawi**	**Tanzania**
Register vaccination location	Generic benchmark	Aligns	Aligns	Aligns
Plan service delivery	Generic benchmark	Aligns	Aligns	Aligns
Register a client	Generic benchmark	Aligns	Aligns	Differs slightly
Administer vaccine(s)	Generic benchmark	Aligns	Aligns	Differs slightly
Remind a client	Generic benchmark	Aligns	Aligns	Differs slightly
Trace a defaulter	Generic benchmark	Aligns	Aligns	Differs slightly
Resolve duplicate client records	Generic benchmark	Aligns	Aligns	Gap
Resolve duplicate vaccination events	Generic benchmark	Aligns	Aligns	Gap
Generate a report	Generic benchmark	Aligns	Aligns	Gap
Create newborn record	Not included	Extends		Extends
Manage arrivals of vaccine and related supplies (stock)	Not included	Extends	Extends	Extends
Distribute supplies to region/district	Not included	Extends	Extends	
Distribute supplies to health center	Not included	Extends	Extends	
Manage vaccine inventory	Not included	Extends		Extends

	9	9	2
Align	100%	100%	22%

Non-Functional Requirements

Non-functional requirements define the quality attributes, performance standards, and operational conditions that a digital immunization system must meet - such as interoperability, usability, scalability, reliability, and data privacy - rather than the specific functions it performs. While major categories such as interoperability, usability, and scalability are addressed, there is greater variation across countries. Ghana shows stronger alignment with WHO standards, while Malawi and Tanzania have more pronounced gaps in areas like system reliability, scalability, and data privacy. These differences reflect varying digital infrastructure maturity and the need for contextual adaptation. By using the results of this analysis, countries can identify specific non-functional requirement gaps and prioritize them for future versions of their localized DAKs, supporting continuous improvement and alignment with evolving global standards.

Table 8: Component 8: Alignment with non-functional requirements

8. Non-functional requirements	WHO DAK v1.0.0	Ghana	Malawi	Tanzania
Performance	Generic benchmark	Some Gap	Some Gap	Some Gap
Compatibility	Generic benchmark	Differs slightly	Differs slightly	Differs slightly
Interoperability	Generic benchmark	Aligns	Aligns	Aligns
Configuration	Generic benchmark	Aligns	Aligns	Aligns
Usability	Generic benchmark	Differs slightly	Differs slightly	Differs slightly
Reliability	Generic benchmark	Differs slightly	Differs slightly	Differs slightly
Confidentiality, privacy, and security	Generic benchmark	Differs slightly	Differs slightly	Differs slightly
Maintainability	Generic benchmark	Some Gap	Some Gap	Some Gap
Portability	Generic benchmark	Differs slightly	Differs slightly	Differs slightly
Scalability	Generic benchmark	Aligns	Aligns	Aligns
General	Generic benchmark	Aligns	Aligns	Aligns

	4	4	4
Align	36%	36%	36%

4. Discussion

Interpretation of Findings

The strong alignment between the WHO Immunization DAK and the localized DAKs across most components demonstrates the feasibility of adapting global digital health standards to diverse country contexts. This alignment validates the SMART Guidelines approach as a scalable and adaptable framework. Divergences - such as the inclusion of workflows for newborn registration, vaccine stock management, or adverse event monitoring - are not deviations from best practice but reflections of country-specific priorities, health system maturity, and operational realities.

Lessons Learned

- **Flexible frameworks are essential:** The ability to extend or adapt DAK components enables countries to address unique needs while maintaining a foundation of global best practices. For instance, Ghana's inclusion of adverse events following immunization (AEFI) workflows and child growth tracking in its DHIS2 e-Tracker was directly informed by its localized DAK.

- **Stakeholder engagement is critical:** All three countries conducted multi-day workshops with broad participation from national, regional, district, and community-level health workers. These workshops helped validate real-world workflows and ensured that the localized DAKs reflected both policy and practice.

- **Localization improves efficiency:** Using the DAK framework to produce country-specific requirements accelerated development timelines and reduced costs. Ghana's experience showed that early engagement with technical partners like HISP-Ghana streamlined system enhancements.

- **Balance between global and local:** While alignment with global standards supports interoperability and scalability, local adaptations are necessary for relevance and sustainability. Malawi's adaptation of the DAK to include adult vaccination workflows within MaHIS, and Tanzania's integration into GOTHOMIS, exemplify this balance.

- **Governance and sustainability matter:** For example, Ghana's approach to maintaining its Digital Adaptation Kit (DAK) through a structured Change Control Board—led by the Ghana Health Service Expanded Programme on Immunization (EPI) and involving the ICT unit—demonstrates the critical role of transparent governance in ensuring version control and long-term system sustainability. By leveraging tools like SharePoint for knowledge management and JIRA for issue tracking and including representation from multiple government departments and relevant service providers, this model reinforces the value of inclusive oversight and consistent system stewardship.

- **Community of practice participation enhances learning:** Engagement in WHO and regional DAK communities of practice allows countries to stay informed of global changes and contribute to shaping future standards.

Implications for Practice and Design
Countries seeking to localize global DAKs should:

- Conduct regular reviews (e.g., on a biannual basis) to maintain alignment with evolving global standards and national immunization schedules.

- Partner with technical experts to interpret and apply updates contextually, ensuring that adaptations are both technically sound and policy-aligned.

- Use structured tools and governance mechanisms to manage versioning and updates, such as Change Control Boards and collaborative platforms.

- Participate in communities of practice to share experiences, learn from peers, and contribute to the evolution of global standards.

- Ensure that localization efforts include frontline health workers and reflect actual workflows, not just policy documents.

- Consider digital infrastructure constraints and plan for hybrid solutions where paper-based systems still coexist with digital platforms.

5. Conclusion

This comparative review underscores that localizing the WHO Immunization DAK is not only feasible but also beneficial. The experiences of Ghana, Malawi, and Tanzania show that countries can achieve strong alignment with global standards while introducing targeted customizations that reflect national priorities and operational realities. On average, countries retained approximately 70–80% alignment across core components, with customizations focused on workflows such as vaccine stock management, newborn registration, and adverse event monitoring.

This approach leads to faster implementation timelines, reduces development costs, and ensures quality assurance by grounding digital system requirements in validated global benchmarks. Localization efforts - when guided by structured frameworks like the DAK - allow countries to save valuable time and resources

while maintaining technical rigor. The ability to balance global consistency with local relevance is key: countries did not need to fully reinvent systems, but rather selectively adapted components to fit their health needs. These findings offer practical guidance for countries and organizations seeking to develop or update digital health standards.

Ultimately, the DAK methodology provides a pathway for countries to build high-quality digital systems that are interoperable, context-aware, and future-ready. As digital health continues to evolve, this model of structured yet flexible adaptation will be essential for achieving sustainable impact.

6. Data Availability Statement

The comparative tables and source documents used in this analysis are available as supplementary material upon request.

7. References

- WHO Immunization DAK (2025)
- Localized DAKs for Ghana, Malawi, and Tanzania

8. Supplementary Material

- Comparative tables and worksheets (see attached files)

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2026