ANNUAL REPORT SUMMARY

DIGITAL INNOVATION IN PANDEMIC CONTROL (DIPC)

TRANSFORMING GLOBAL HEALTH THROUGH DIGITAL SOLUTIONS



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INTRODUCTION TO DIPC

In response to the profound challenges posed by the COVID-19 pandemic, the Digital Innovation in Pandemic Control (DIPC) initiative, funded through the German Ministry of Economic Development (BMZ) Last Mile Fund, has emerged as a dynamic force in shaping resilient health systems globally. With collaborative efforts from implementing partners such as the United Nations International Children's Emergency Fund (UNICEF), Digital Square/PATH, the Pan American Health Organization (PAHO), Regenstrief Institute, and the Robert Koch Institute (RKI), DIPC strategically navigates the digital transformation to fortify health systems on a national, regional, and global scale.

OUR AIM AND VISION

DIPC identifies, fosters, and promotes digital innovation to solve health and country-specific challenges by strengthening pandemic prevention, response, and vaccine delivery on a national and global scale. The initiative leverages human centered digital transformation to mitigate global health crises.

DIPC is based on the hypothesis that the demand-driven introduction, expansion, and integration of digital solutions for vaccine distribution processes (vaccine logistics) as an integral component of resilient health systems will strengthen pandemic prevention and response at national and global levels. Thereby, the initiative aims to reduce the occurrence, spread and consequences of existing and emerging infectious diseases such as COVID-19. However, digital support to routine vaccine delivery in DIPC partner countries is expected to have impact beyond pandemic control: Increased vaccine coverage is associated with reducing disease burden and mortality. It is additionally connected to greater social benefits, including improved economic outcome, education levels and survival especially for disadvantaged groups such as women, children, and rural populations. All these processes can be supported by digital tools and linked through interoperability.



IMPLEMENTATION OF DIPC

Global **Global GIZ** Initiatives Learning Platform (Atingi) Collaborating Projects Data4Policy EU Digital Alliance GovStac Global Stakeholders (WHO SG WG)



DIPC ACTIVITIES

DIPC executes different activities to reach the established goals and make the vision a reality. Therefore, the initiative is divided into two phases.

PHASE I (2019 - 2022)

DIPC Phase I started in 2019 and strengthens digital health systems in three interconnected Work Packages (WPs):

WPA:

The Digital Pandemic Preparedness Assessment (DPPA) captures and explores existing digital applications in 5 countries (Ghana, Nigeria, Togo, Sierra Leone, Ivory Coast) that can be used for vaccine distribution and pandemic control.

WP B:

DIPC, together with the World Food Programme, launched the Digital Health Innovation Accelerator, which has provided financial, technical, and methodological support for further development of promising digital solutions. Ventures that develop and strengthen digital solutions in the context of pandemic prevention and response have been supported in coordination with the respective government partners until the end of 2023.

WPC:

Established the multilateral DICE, led by WHO and UNICEF. DICE provides targeted advice on the use of digital solutions in the global south. To further operationalize these goals and implement the WHO SMART Guidelines, which ensure a standardized and evidence-based foundation for its interventions.

PHASE II (2022 - 2024)



2

3

4

program planning.

DIPC Phase II has structured its approach into four WPs.

WP1 COUNTRY IMPLEMENTATION:

Together with national governments and implementing partners (Digital Square, Unicef and PAHO), works to strengthen digital health systems for vaccine logistics and pandemic prevention and response in Ghana, Sierra Leone, Tanzania, Malawi and Peru through the integration and scale of digital solutions and the adaptation of the WHO SMART Guidelines.

WP2 GLOBAL PRODUCT SUITE:

Combines mature software into interoperable product suites, which meet the specifications of the WHO SMART Guidelines for routine vaccination and create a seamless end to end functionality and data flow.

WP3 TRAINING AND CAPACITY BUILDING:

Strengthens capacity of digital health specialists responsible for developing, maintaining, and customizing digital health systems in partner countries through an online training course hosted on atingi.

WP4 OPERATIONAL AND STRATEGIC RESEARCH:

Conducts operational and strategic research for the program evaluation and strategic







DIPC IMPLEMENTING PARTNERS









EU-LAC countries Colombia, Brasil, Ecuador

WP1 - COUNTRY IMPLEMENTATION

DIPC is implemented in Peru, Ghana, Tanzania, Malawi, and Sierra Leone, with each country receiving tailored digital health solutions based on its specific needs.

- 1. Peru: DIPC has helped identify and address data fragmentation in vaccine logistics. The focus is on developing digital solutions for remote areas, particularly those with poor connectivity.
- 2. **Ghana:** DIPC supports the enhancement of the **e-tracker** system to improve vaccine distribution workflows.
- 3. **Tanzania:** DIPC works with the Ministry of Health to update the Tanzania Immunization Registry, ensuring that digital tools are used effectively.
- 4. Malawi: DIPC has supported the development of an immunization registry, integrated into the national hospital system.
- 5. Sierra Leone: DIPC focuses on improving governance and leadership in digital health, particularly by developing a national digital health investment roadmap.

During 2023, the Country Implementation adopted a multi-faceted approach across Peru, Malawi, Tanzania, Ghana, and Sierra Leone, focusing on ecosystem mapping to better understand each country's digital immunization system. Engagement with governments and stakeholders, including a gender-inclusive perspective, helped identify specific needs and challenges. A key element has been the localization of the WHO SMART Guidelines into Digital Adaptation Kits (DAK), ensuring countryspecific adaptations, addressing interoperability, and promoting innovation through hackathons.

KEY FINDINGS INCLUDE:

- **Peru:** Interoperability barriers, data exchange issues, and the need for common standards.
- **Tanzania:** Priorities include updating the immunization registry and training health workers.
- Ghana: Infrastructure challenges, functional gaps, and a plan to enhance the DHIS2 e-Tracker.
- **Sierra Leone:** Leadership and infrastructure challenges as they move to the second phase of DAK localization.
- Malawi: Focus on interoperability, standards, and user-centric digital health interventions.



WHO SMART GUIDELINES FROM TREATMENT STANDARD TO SOFTWARE:



The DIPC project plans to enhance existing digital health systems by addressing the need for an immunization product suite comprised of global good/s and other open-source technologies that will provide a digital health solution across immunization service delivery workflows applicable across diverse geographies. This will assist ministries of health, especially in low- and middle-income countries (LMICs), to more rapidly utilize digital technologies to provide a fully integrated solution that supports effective immunization service delivery, ultimately strengthening data-driven health systems and future pandemic preparedness. Although there are many digital health solutions that cater to specific functional areas within the workflow-such as electronic immunization registries (EIRs), community-based tools, reporting systems, etc.—these still require significant work to achieve an interoperable solution that supports the full end-to-end immunization use case. Many countries have digital systems in place that already support key functions of the workflow and/or have the capacity to support technologies and

may be looking for additional components that can be added to existing systems to provide an integrated immunization solution that aligns with their national digital health strategies and health enterprise architecture. A product suite provides that flexibility and should be designed to incorporate existing systems rather than replace them.

Product suites are aligned with the World Health Organization's (WHO) Standards-based, Machine-readable, Adaptive, Requirements-based, and Testable (SMART) Guidelines. Product suites should use the level two (L2) (operational) and L3 (machine-readable) components to produce L4 (executable) reference software. Anaemia**B.1.1:** Full blood count testing is the recommended method for
diagnosing anaemia in pregnancy. In settings where full blood count
testing is not available, on-site haemoglobin testing with a hae-
moglobinometer is recommended over the use of the haemoglobin
colour scale as the method for diagnosing anaemia in pregnancy.

INPUTSOUTPUTSACTION"Blood haemoglobin
test result" <110g/L</td>*Anaemia diagnosis –
*Positive for anaemiaConduct REQUIRED
anaemia counselling"Gestional age"
< 12 weeks</td>"Amount of iron
prescribed" - 120 mg

/* codesystem "LOINC": 'http://loinc.org' code "Hb": '718-7' from "LOINC" display 'Haemoglobin measured from haemoglobinometer (g/dl)' */ code "Hb": '165395AAAAAAAAAAAAAAAAAAAAAAAAAAAAAA from Common.OpenMRSEntity display 'Haemoglobin measured from haemoglobinometer (g/dl)'



Decision support: - "Conduct anaemia counseling" "Prescribe Iron 120mg"

Collect standardized data to the health satck



WP3 - TRAINING AND CAPACITY BUILDING

WP3 focuses on addressing gaps in **digital health capacity** by providing structured training and learning programs at both the local and global levels. DIPC has implemented a **needs-based approach** to ensure that healthcare workers, decision-makers, and community agents are trained in using digital health tools.

KEY COMPONENTS OF WP3

GLOBAL ELEARNING COURSE:

Launching in February 2024, this course will be available on the atingi platform. It is designed to strengthen digital health skills for IT professionals and healthcare workers, addressing critical gaps in digital literacy.

LOCAL TRAINING PROGRAMS:

These initiatives target the specific needs of each partner country, including Peru, Ghana, Tanzania, Malawi, and Sierra Leone. The training programs cover a range of digital health topics, from basic skills to more advanced health information system management.

CAPACITY-BUILDING INITIATIVES:

DIPC focuses on ensuring that health systems have the human resources necessary to manage and expand digital health solutions. This includes peer-to-peer collaboration, creating a learning community, and continuous professional development.

WP3 emphasizes sustainable capacity building, ensuring that countries can maintain and develop their digital health systems over the long term. The **Regenstrief Institute** has played a key role in developing the course curriculum and training materials, ensuring that they meet the needs of low- and middle-income countries (LMICs).



WP4 - OPERATIONAL AND STRATEGIC RESEARCH

WP3 focuses on addressing gaps in **digital health capacity** by providing structured training and learning programs at both the local and global levels. DIPC has implemented a **needs-based approach** to ensure that healthcare workers, decision-makers, and community agents are trained in using digital health tools.

KEY ASPECTS OF WP4

RESEARCH PRIORITIES:

WP4 defines key research areas, focusing on how digital health solutions can improve vaccine distribution, enhance pandemic preparedness, and support routine immunization.

OPERATIONAL RESEARCH:

This includes program evaluation to assess the effectiveness of digital health interventions in real-world settings. WP4 supports strategic planning by gathering evidence on what works and what doesn't, allowing DIPC to fine-tune its solutions.

GLOBAL PARTNERSHIPS:

WP4 collaborates with institutions like the **Robert Koch Institute (RKI)**, which contributes to **strategic research** and evaluation efforts.

This partnership provides insights into **pandemic preparedness**, and the evidence gathered helps shape future investments in digital health.

CONTINUOUS EVALUATION:

WP4 ensures that digital health solutions are regularly assessed for effectiveness, scalability, and sustainability. By leveraging data from multiple sources, WP4 helps improve digital health policies and guides the future direction of DIPC.

WP4 positions DIPC as a **catalyst for innovation** in digital health by providing the research and evidence needed to drive sustainable improvements in health systems.

Logic Model Development



RKI developed the DIPC project's Logic Model and Kev Performance Indicators (KPIs).

Deliverables by RKI in the DIPC Project



CONCLUSION

In summary, the DIPC initiative has made significant progress in integrating digital tools into national health systems, particularly in the areas of vaccine distribution and pandemic preparedness. Through its four interconnected Work Packages, DIPC has laid a solid foundation for resilient health systems capable of adapting to future challenges. Looking forward, DIPC's next steps include scaling digital solutions across partner countries, launching a global e-learning course in early 2024 to address critical digital health skills gaps, and continuing its operational and strategic research to evaluate and improve the effectiveness of interventions.

To achieve this vision, the DIPC project follows a comprehensive logic model that outlines the progression from resources to long-term impact. The model includes five key components: inputs, which refer to the resources and partnerships fueling the initiative; activities, encompassing the actions taken to implement digital health solutions; outputs, representing the immediate results of these efforts; outcomes; and ultimately, the impact, aimed at creating more resilient, equitable global health systems.

A6

Facilitate political dialogues on the national and regional level around the topic of cross-border and in-country data use and data sharing for pandemic prevention and outbreak control

DIPC LOGIC MODEL



GLOBAL PANDEMIC STATISTICS

GLOBAL AND COUNTRY-SPECIFIC COVID-19 STATISTICS (2023)

GLOBAL COVID-19 CASES AND VACCINATION

770 Million

7 Million

Total confirmed Covid Cases

Total Deaths

Source: World Health Organization, COVID-19 Dashboard, 2023

12.9 billion vaccine doses have been administered globally, with **73%** of the world's population having received at least one dose of a COVID-19 vaccine.

GLOBAL AND COUNTRY-SPECIFIC IMMUNIZATION COVERAGE

GLOBAL IMMUNIZATION COVERAGE (2022)

81% of infants worldwide received three doses of the **DTP3** (diphtheria, tetanus, and pertussis) vaccine, a common measure of immunization system performance.

Source: WHO, "Immunization Coverage", 2022

23 million children did not receive basic vaccines in 2022, indicating challenges in access to routine immunization in LMICs.

KEY STATISTICS ON PANDEMIC PREPAREDNESS AND HEALTH SYSTEM RELIENCE

GLOBAL PANDEMIC PREPAREDNESS

According to a WHO report, only **40%** of countries worldwide had pandemic preparedness plans before COVID-19.

Source: Global Health Security Index (GHSI), 2021

DIGITAL HEALTH READINESS

The Global Health Security Index (2021) ranks countries based on their capacity to handle pandemics. Many LMICs, including some DIPC countries, scored low on health system resilience.

Source: Global Health Security Index, Tanzania and Sierra Leone Country Profiles, 2021

After the pandemic, over **70%** of countries now have **digital pandemic response plans**, although significant gaps remain in LMICs.

Tanzania and Sierra Leone scored in the bottom **30%**, highlighting the need for improved digital health infrastructure and training.

STATISTICS ON DIGITAL INNOVATION IN PANDEDMIC CONTROL

VACCINE COVERAGE AND DROPOUT RATES

GLOBAL DROPOUT RATES

In 2022, approximately **10%** of children who received the first dose of the **DTP (diphtheria**, tetanus, pertussis) vaccine did not complete the recommended series, resulting in significant gaps in immunity.

This indicates a breakdown in the vaccination follow-up process that could be improved with digital tracking and reminders for parents.

IN LOW- AND MIDDLE-INCOME COUNTRIES (LMICS)

The dropout rate between the first and third doses of DTP3 in many LMICs is **12-15%**, often due to inadequate tracking and communication systems for immunization schedules.

Digital innovations such as **immunization regis**tries, SMS reminders, and mobile applications can ensure that children complete their vaccination schedules by improving record-keeping, follow-up, and engagement with parents.

VACCINE WASTAGE AND STOCKOUTS

GLOBAL VACCINE WASTAGE

The World Health Organization (WHO) estimates that up to 50% of vaccines globally are wasted, often due to improper storage, transportation issues, or lack of data on vaccine demand.

VACCINE STOCKOUTS IN LMICS

34% of healthcare facilities in LMICs report sto**ckouts** of at least one essential vaccine annually, largely due to poor inventory management and lack of real-time tracking of stock levels.

Digital innovations such as **real-time vaccine stock** management systems, cold chain monitoring using IoT devices, and **data analytics** for demand forecasting can significantly reduce wastage and stockouts by improving visibility and planning in the supply chain.

In some countries, stockouts of vaccines like measles and polio have been reported in 20-**30%** of facilities.

COLD CHAIN EFFICIENCY

GLOBAL COLD CHAIN CHALLENGES

28% of vaccines in LMICs are exposed to temperatures outside the recommended range, leading to compromised potency and inefficacy.

COLD CHAIN FAILURES IN AFRICA

In Africa, 37% of vaccines are exposed to heatsensitive environments due to inadequate cold chain equipment, according to UNICEF.

Digital solutions like IoT-based cold chain monitoring, temperature sensors, and automated alerts can ensure that vaccines are stored and transported within the correct temperature ranges, reducing spoilage and increasing vaccine efficacy.

HEALTHCARE WORKFORCE AND TRAINING

HEALTHCARE WORKER SHORTAGES

WHO estimates that by **2030**, there will be a global shortage of **18 million** healthcare workers. particularly in LMICs. This shortage impacts the ability to manage immunization campaigns efficiently.

TRAINING GAPS IN VACCINE LOGISTICS

Less than **30%** of healthcare workers in LMICs have received adequate training in vaccine ma**nagement**, including the proper use of digital tools to track and manage immunization schedules.

Digital learning platforms, e-learning for vaccine logistics management, and mobile**based tools** for healthcare workers can help bridge training gaps, making the immunization process more efficient.

DATA GAPS AND INEFFICENT **RECORD KEEPING** LACK OF DIGITAL HEALTH RECORDS

In **50%** of LMICs, immunization data is still recorded manually, resulting in frequent errors, data loss, and an inability to track immunization coverage effectively.

Only 30% of African countries have functioning electronic immunization registries, leading to major gaps in data for vaccination coverage.

Implementing digital health records, electronic immunization registries, and data dashboards can improve data accuracy, allow real-time tracking, and facilitate better decision-making for immunization programs.

COST OF INEFFICIENCIES IN VACCINE DELIVERY

FINANCIAL LOSSES

Wastage, stockouts, and cold chain failures contribute to annual vaccine delivery losses estimated at **\$100 million** globally.

The cost of inefficient vaccine delivery in LMICs could be reduced by **30-40%** with the implementation of digital systems for inventory and supply chain management.

Digital innovations in supply chain management—such as **blockchain for traceability.** demand forecasting tools, and AI-based *analytics*—can significantly reduce these financial losses and optimize the immunization process.

ACCESS AND EQUITY

EQUITY GAPS IN IMMUNIZATION COVERAGE

23 million children worldwide did not receive basic vaccines in 2022, with the majority located in remote or underserved region

Mobile health solutions (mHealth), geospatial mapping, and community-based digital tools can improve outreach to remote areas, ensuring equitable access to vaccines and closing gaps in coverage.

60% of unimmunized children live in **10 countries**. most of which have limited access to digital tools that could help manage immunization outreach.

REFERENCES

Global Dropout Rates: WHO/UNICEF Joint Estimates, 2022 Training Gaps: WHO, "Global Health Workforce Statistics", 2023

GLOBAL IMMUNIZATION DATA ACCURACY

MANUAL DATA ENTRY ISSUES

In LMICs, manual entry processes lead to data inaccuracies and delays in updating vaccination records. Up to 40% of vaccine data in some regions is estimated to be incomplete or incorrect.

Automated data capture, digital health tools, and data validation systems can reduce human error, speed up record-keeping, and ensure more accurate tracking of vaccination coverage.



- WHO Vaccine Wastage Statistics: WHO, "Monitoring Vaccine Wastage at Country Level", 2022
- Vaccine Stockouts: Gavi, "Vaccine Supply Chains: Striving for Supply Chain Excellence", 2022
- **Cold Chain Challenges:** UNICEF, "Cold Chain Equipment and Monitoring", 2022
- Data Gaps in Immunization Records: WHO, "Global Vaccine Action Plan Report", 2022

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IMPLEMENTING PARTNERS:



United Nations International Children's Emergency Fund (UNICEF):

www.unicef.org/sierraleone/

In Sierra Leone, the DIPC partners with UNICEF, which focuses on improving global healthcare through digital innovations for children and vulnerable populations. During DIPC Phase I, UNICEF implemented WP C by introducing the DICE instrument to address digital health needs during the COVID-19 pandemic. In Phase II, UNICEF continues to support DIPC in Sierra Leone, where it has operated for over 30 years, focusing on implementing WP1 and addressing local training needs under WP3.

PATH

Digital Square/PATH:

www.digitalsquare.org/

Digital Square, through PATH, serves as the implementing partner for the DIPC initiative in Ghana, Tanzania, and Malawi, particularly for WP2. Since the start of the COVID-19 pandemic, Digital Square has used its expertise and global digital health connections to help countries adopt digital tools for prevention and response efforts. Their role in the DIPC initiative spans WP1, WP2, and WP3, focusing on enhancing immunization workflows to build more resilient and sustainable health systems, preparing countries for future pandemics.



The Pan American Health Organization (PAHO):

www.paho.org/es

The Pan American Health Organization (PAHO) is the international health agency for the Americas and the Regional Office of the World Health Organization. It provides technical cooperation and mobilizes partnerships throughout the region to improve health and guality of life in the countries of the Americas. PAHO acts as an implementing partner within WP1 for DIPC in Peru as well as in the region.



The Regenstrief Institute:

www.regenstrief.org/

The Regenstrief Institute is a key partner, collaborating with the OpenHIE Community to create an open-source course that addresses unmet needs in digital health. As a research organization focused on connecting and innovating for better health, Regenstrief's mission is driven by a vision of empowering people through better information to combat disease and achieve true health. They contribute to this vision by developing a global e-learning course and localized offline materials, playing a crucial role in WP3

ROBERT KOCH INSTITUT

The Robert Koch Institute (RKI):

www.rki.de/EN/Home/homepage node.html

The Robert Koch Institute (RKI) is a key public health institution in Germany, operating under the Federal Ministry of Health, with a significant role in disease control and prevention both nationally and internationally. Its Evidence-based Public Health Unit (ZIG 2) focuses on improving global public health by generating, evaluating, and applying strategic information.

ZIG 2 supports international health policies by conducting systematic reviews, developing research methods, and prioritizing health projects. As part of the DIPC initiative, ZIG 2 aims to evaluate the project based on the OECD's five criteria: relevance, effectiveness, efficiency, impact, and sustainability.



