TDR For research on diseases of poverty

UNICEF • UNDP • World Bank • WHO

LOCAL SOLUTIONS FOR GLOBAL IMPACT

Annual Report 2023

Research for Implementation

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List of abbreviations

ADP	Access and Delivery Partnership (UNDP)
aDSM	anti-TB drug-safety monitoring and management
AFRO	WHO Regional Office for Africa
AFROHUN	Africa One Health University Network
AMR	antimicrobial resistance
AMRO	WHO Regional Office for the Americas
CAD	computer-assisted detection
CARN-TB	Central African Regional Network for TB Control
CDC	Centers for Disease Control and Prevention (for Africa, the US, and China)
COVID-19	coronavirus disease 2019; SARS-CoV-2
DEC	disease-endemic country
DIAMA	**DIA**gnostics for **M**ultidrug-resistant tuberculosis in **A**frica
DND*i*	Drugs for Neglected Diseases *initiative*
ECOSUR	El Colegio de la Frontera Sur, Mexico
EDCTP	European and Developing Countries Clinical Trials Partnership
EMRO	WHO Regional Office for the Eastern Mediterranean
ER	expected result
EURO	WHO Regional Office for Europe
EWARS	Early Warning and Response System
FAO	Food and Agriculture Organization
FGD	focus group discussion
GAVI	Global Alliance for Vaccines and Immunization
GBIF	Global Biodiversity Information Facility
GFATM	Global Fund to Fight AIDS, Tuberculosis and Malaria
GLAI	Global Arboviral initiative
GVH	Global Vector Hub platform
HIV	human immunodeficiency virus
IAEA	International Atomic Energy Agency
icddr,b	International Centre for Diarrheal Disease Research, Bangladesh
IDDO	Infectious Diseases Data Observatory
IDI	in-depth interview
IDRC	International Development Research Centre (Canada)
IMP	TDR Research for Implementation Unit
IPC	infection prevention and control
IR	implementation research
IRS	indoor residual spraying
IWP	insecticidal wall painting
JCB	TDR Joint Coordinating Board
KCRI	Kilimanjaro Clinical Research Institute
KEMRI	Kenya Medical Research Institute
KII	key informant interview

LLIN	long-lasting insecticidal net
LMIC	low- or middle-income country
LSHTM	London School of Hygiene and Tropical Medicine
Malakit	self-diagnosis and treatment kit for mobile and hard-to-reach communities
M&E	monitoring and evaluation
MBD	mosquito-borne disease
MDA	mass drug administration
MDGH	Medicines Development for Global Health
MDR-TB	multidrug-resistant tuberculosis
MMV	Medicines for Malaria Venture
MoH	Ministry of Health
MOOC	massive open online course
MoU	Memorandum of Understanding
MPH	Master of Public Health
MSA	multisectoral approach
MSM	men who have sex with men
NGO	nongovernmental organization
NIH	National Institutes of Health (US)
NIPD	National Institute of Poverty Diseases
NMP	national malaria programme
NTD	neglected tropical disease
NTP	national tuberculosis programme
NTPS	National TB Prevalence Survey
OH	One Health (approach)
OPT-MVAC	Optimizing the effectiveness of Malaria VACcine
OPT–SMC	Optimizing Seasonal Malaria Chemoprevention Project
OR/IR	Operational and/or implementation research
PI	Principal investigator
PKDL	Post kala-azar dermal leishmaniasis
R&D	research and development
RTC	Regional Training Centre
SDC	Swiss Development Cooperation
SDF	Strategic Development Fund
SDG	Sustainable Development Goals
SEARN-TB	Southern and East African Network for TB control
SEARO	WHO Regional Office for South-East Asia
ShORRT	**Sh**ort, all-**O**ral **R**egimens for **R**ifampicin-resistant **T**uberculosis
Sida	Swedish International Development Cooperation Agency
SIT	Sterile Insect Technology
SMC	seasonal malaria chemoprevention
SOP	standard operating procedure
SORT IT	Structured Operational Research and Training Initiative

STAC	TDR Scientific and Technical Advisory Committee
STH	soil-transmitted helminth
STPH	Swiss Tropical and Public Health Institute
SWG	Scientific Working Group
TDA4Child	Treatment-decision algorithm for Children
TDA	treatment decision algorithm
TDR	UNICEF/UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases
TGM	transgender men
TGW	transgender women
The Union	International Union Against Tuberculosis and Lung Disease
TPHPA	Tanzania Plant Health and Pesticides Authority
UHC	universal health coverage
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNICEF	United Nations Children's Fund
Union, the	International Union Against Tuberculosis and Lung Disease
USAID	United States Agency for International Development
US-FDA	United States Food and Drug Administration
VBD	vector-borne disease
VCAG	Vector Control Advisory Group (WHO)
VL	Visceral Leishmaniasis
WARN-TB	West African Regional Network for TB control
WASH	water use, sanitation and hygiene
WHO	World Health Organization
WHO–ECCH	Environment, Climate Change and Health Department
WHO–ERC	WHO Ethics Review Committee
WHO–GMP	WHO Global Malaria Programme
WHO–GTB	WHO Global TB Programme
WHO–NTD	WHO Control of Neglected Tropical Diseases Department
WHO–PHE	WHO Public Health, Environmental and Social Determinants of Health Department
WHO–PV	WHO Pharmacovigilance Department
WHO–WASH	WHO Water, Sanitation and Hygiene group
WPRO	WHO Regional Office for the Western Pacific
WSW	women who have sex with women

Introduction

Research for implementation is one of the three strategic priority areas of the UNICEF/UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR) within its 2018–2023 strategy. The supported research activities are contributing to achievement of the Sustainable Development Goals (SDGs) by 2030, specifically SDG 3 "*Ensure healthy lives and promote well-being for all at all ages",* and SDG 10 *"Reduce inequalities within and among countries*", as well as supporting universal health coverage (UHC).

The Research for Implementation (IMP) unit activities focus mainly, but not exclusively, on research leading to the development of policies and guidelines and their effective implementation in public health programmes. Activities also produce the evidence needed to reduce the burden of infectious diseases of poverty in low- and middle-income countries (LMICs).

Objectives

The Research for Implementation activities focus on finding new solutions to reduce the burden of infectious diseases of poverty and ensure access to health technologies for those in need. The following four main aims of research are included within TDR's current strategy:

- **RESEARCH FOR POLICY**: to understand and produce evidence on large-scale performance, acceptability, feasibility, implementation needs and potential impact of available tools as a basis for determining what tools are suitable for guidelines and policies
- **RESEARCH FOR IMPLEMENTATION**: to understand and address barriers to effective, quality and equitable implementation of health interventions, strategies, guidelines and policies to provide the evidence as to how these can best be implemented for maximum impact
- **RESEARCH FOR INNOVATION**: to provide directions for the development of improved and adapted new tools and strategies needed, and to promote their development and use
- **RESEARCH FOR INTEGRATED APPROACHES**: to understand the complex interactions between people and their environment that affect disease transmission

The above-mentioned objectives are being implemented through 11 Expected Results (ERs) that have been developed in coordination with IMP's Scientific Working Group (SWG).

Key achievements for the strategic priority area in 2023

- An early warning and response system (EWARS) against arboviral disease outbreaks is integrated into the national surveillance system in Mexico and is piloted in 15 other countries. Lessons from Mexico are published in a peer-reviewed journal.
- Multisectoral approaches (MSAs) against prevention and control of vector-borne diseases (VBDs) were implemented in seven African countries against malaria and in two countries against arboviral diseases, with evidence of impact on transmission of diseases.
- Integration of a self-diagnosis and treatment kit for mobile and hard-to-reach communities (Malakit) into the national malaria programme in Surinam yielded positive results (with no autochthonous cases in 2023).
- One Health was operationalized as a transdisciplinary ecosystem approach addressing various diseases (including fascioliasis, schistosomiasis and VBDs) in the context of climate change through eight projects supported in Africa.

- Further evidence was generated and disseminated on the positive effect of operational research on healthcare practice, with several cases studies on tackling antimicrobial resistance (AMR) through the Structured Operational Research and Training Initiative (SORT IT) approach published in peer-reviewed journals.
    - Of the first 49 SORT IT studies assessed for impact, 78% influenced policy and/or practice at national, regional and health facility levels. Regarding collateral benefits to the health system, 90% of trainees applied SORT IT skills to AMR practice and 63% to tackling emerging infections.
- West African institutions were supported to access and conduct operational research on Ebola and COVID outbreak data stored at Oxford.
    - Ten research projects investigated questions on surveillance, case-finding and clinical care for outbreak management of emerging infections.
- Progress was made on testing sterile insect technology (SIT) against arboviral diseases.
    - Preparations for testing is under way in two countries and a third will follow in 2024. A preparatory training workshop was held in May 2023 in Tahiti in French Polynesia, with 20 countries from all WHO regions represented. For consideration by WHO as a new vector control tool, the SIT was presented at the Vector Control Advisory Group (VCAG19) in September 2023,
- A new regional network of national TB programmes (NTPs), the Southern and East African Network for TB control (SEARN-TB), was launched, targeting 24 countries in the region.
- A generic research package was developed to:
    - conduct root cause analysis of yellow fever outbreaks in African countries in collaboration with Eliminate Yellow fever Epidemics (EYE) (by 2026);
    - evaluate the impact of social protection schemes for TB patients and their families, with piloting initiated in six African countries; and
    - evaluate the WHO Treatment Decision Algorithm (TDA) for Childhood TB (TDA4Child) to inform WHO guidelines.
- New evidence was generated on core challenges of visceral leishmaniasis (VL) elimination on the Indian subcontinent.
    - Insecticidal wall painting (IWP) was identified as the best alternative to indoor residual spraying (IRS) for vector control.
    - Indigenous focal transmission of VL is occurring in new foci in Nepal.
    - Post kala-azar dermal leishmaniasis (PKDL) integrated surveillance in leprosy facilities feasible.
- Evidence informs policy in countries.
    - New foci are being included into programme areas in both Nepal and Bangladesh. PKDL screening is being conducted around households with VL cases in Bangladesh.
    - A broad stakeholder consultation recommended the launch of a regional VL elimination initiative in East Africa.
- More evidence was generated on gender and its intersection with social stratifiers in healthcare-seeking behaviour in different countries and against various infectious diseases, as well as among the urban poor. Findings were published in six articles (including lymphatic filariasis in Nepal, and schistosomiasis in Uganda).
    - Findings were published in two articles and two are under review.
    - Further work is under way on multidrug-resistant tuberculosis (MDR-TB) in Bangladesh and malaria services in Ethiopia, TB and dengue care and services in Bhutan, and TB malaria and prevention and control in Kenya, Malawi and South Africa.

- A massive open online course (MOOC) was rolled out on "Incorporating an Intersectional Gender Perspective in Implementation Research".
- Evidence generated from systematic reviews on gender dimensions of health-related challenges among the urban poor during COVID-19 in LMICs was disseminated through peer-reviewed publications and policy dialogues.
  - Four articles published.
  - Two dissemination sessions held with various stakeholders including policy-makers.
  - Research gaps identified.

Summary progress description for 2023

Technical implementation faced some delays due to conflicts, slow approval processes, and investigator and stakeholder constraints in a number of projects.[1] Nevertheless, among the 11 Expected Results (ERs), nine have already met biennium targets in Q3 and for the other two, critical outputs have already been achieved despite delays with minor tasks.

TDR project support often occurs over several years, and in some cases, across different diseases. Table 1 provides a summary of current progress within the overall plan of ERs. More details on progress are provided as narrative in the pages below.

Table 1. Research for Implementation workplan overall progress

Expected Results – Research for implementation	
Expected results and deliverables	***Indicators and targets***
Research for policy	
1.1.1 Country preparedness for disease outbreaks: i) expanded capacity of countries to use EWARS tool; and ii) regional plan to improve arbovirus disease surveillance and vector control in West Africa.	By 2023: • Ten countries using the EWARS tool • A situation analysis report on improved arbovirus disease surveillance and vector control in West Africa published *Progress made:* ▪ *EWARS is at various stages of implementation in 16 countries.* ▪ *The situation analysis on arbovirus disease surveillance and vector control for Africa was published.*
1.1.4 Country resilience to the threat of drug-resistant infections: i) OR/IR strategies for countries to build effective systems for monitoring and responding to emerging drug resistance; ii) documentation of practical approaches to improve targeted treatment and reduce drug misuse and risk of resistance; and iii) strategies for monitoring and responding to potential emergence of drug resistance.	By 2023, strategies for countries to build effective systems for monitoring and responding to emerging drug resistance endorsed by stakeholders at relevant levels. *Progress made:* ▪ *A total of 97 relevant policy and practice research studies were completed in seven countries and published by December 2023. Of the first 60 of these studies assessed for impact, 79% had an impact on shaping policy and/or practice at*

[1] Examples of this are SORT IT studies in Central and Eastern Europe, a multisectoral approach case study in Burkina Faso and VL studies in Eastern Africa.

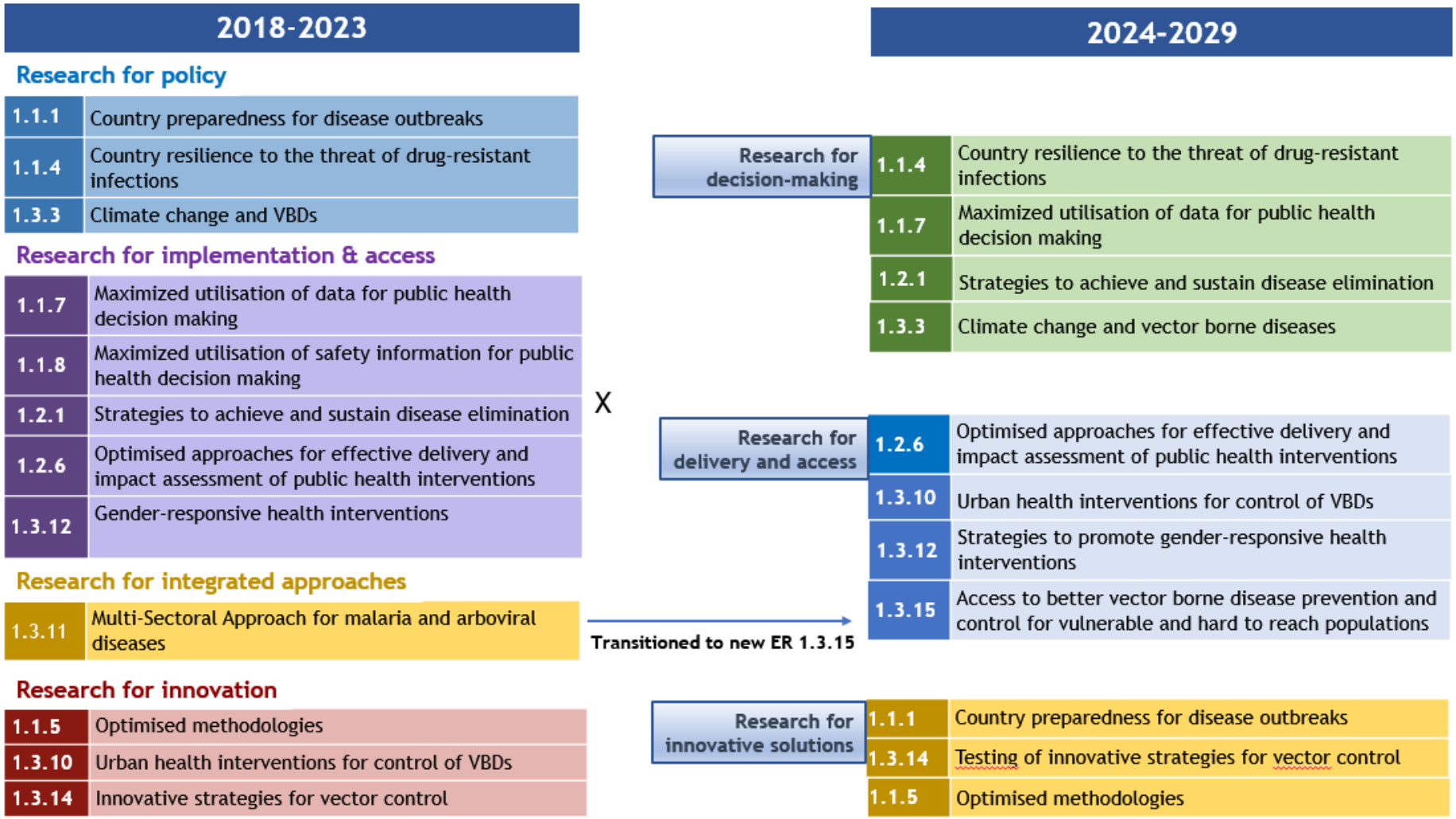
Expected Results – Research for implementation	
Expected results and deliverables	***Indicators and targets***
	national, regional and health facility levels. There are 12 publications that showcase the impact on policy and practice from Ghana, Nepal and Sierra Leone.
1.3.3 Population health vulnerabilities to vector-borne diseases: increasing resilience under climate change conditions: i) call for proposals for scaled up One Health transdisciplinary ecosystem approach for vector borne diseases in the context of climate change in Africa; ii) implementation of an online training course on Operationalizing One Health; and iii) research uptake meeting with researchers, project stakeholders and collaborators.	By 2023: • Research uptake meeting successfully conducted • 20-40 African researchers trained in Operationalizing One Health through an online training course (offered once a year in 2022 and 2023) *Progress made:* ▪ *One Health webinars conducted. TDR One Health project support presented at Clim-Health Africa meeting.* ▪ *An online curriculum was piloted and 23 investigators were trained in Kenya.*
Research for implementation	
1.1.7 Maximized utilization of data for public health decision-making: i) capacity built for effective collection, analysis and use of data; and ii) publications and policy briefs suitable for informing evidence-based policies/practice guidelines.	By 2023, 15 publications and evidence of change in policies/practice (30 for the US$ 50 million scenario) *Progress made:* ▪ *A total of 98 publications (58 publications in 2022 and 40 by December 2023) and teams of healthcare workers trained on protocol writing, effective collection, analysis and use of data, and research communication. Sixty-eight per cent of research studies influence policy and/or practice with 100% LMIC first authorship.*
1.2.1 Strategies to achieve and sustain disease elimination: i) evidence on sustainable strategies for the elimination of VL in the Indian subcontinent; ii) evidence to support establishment of programmes towards elimination of VL in East Africa; iii) improved basis for monitoring progress of preventive chemotherapy-based programmes towards elimination and for decisions to stop interventions; and iv) data to support WHO guidelines and onchocerciasis-endemic country registration and policies on moxidectin for onchocerciasis elimination.	By 2023: • New results on sustainable VL elimination strategies delivered to country control programmes • Results on improved basis for monitoring progress of preventive chemotherapy-based elimination programmes delivered to control programmes *Progress made:* ▪ *New evidence generated on strategies to sustain VL elimination in Bangladesh and Nepal informing policy change (five publications).* ▪ *Progress to date on the diverse (though research synergistic) tools suggests that ≥1 will be available for large-scale piloting by onchocerciasis control (elimination) programmes by the end of 2023.*

Expected Results – Research for implementation	
Expected results and deliverables	***Indicators and targets***
1.2.6 Optimized approaches for effective delivery and impact assessment of public health interventions: i) extend the WARN-TB approach to other geographical areas and/or other disease burdens; ii) capacity strengthened for improving the effectiveness of safety monitoring of new drugs in target countries; and iii) approaches to optimized delivery and effectiveness of seasonal malaria chemoprevention in West and Central Africa evaluated and other NTD control strategies.	By 2023: • Report on the expansion provided to stakeholders at country, regional and global levels • Serious adverse event reporting rates in target countries improved • Report on approaches to optimized delivery of seasonal malaria chemoprevention provided to stakeholders at country, regional and global levels *Progress made:* ▪ *SEARN-TB was established in May 2023, using the same model as WARN-TB.* ▪ *The increased number of serious adverse event reports in countries which introduced digital tools is documented in written and oral communication.* ▪ *Eleven countries implemented seasonal malaria chemoprevention (SMC) and conducted implementation research (IR) projects to optimize the impact of SMC.*
1.3.12 Strategies to promote gender-responsive health interventions on prevention and control of infectious diseases of poverty. New knowledge and evidence on intersection of sex and gender with other social stratifiers to address power relations, social exclusion, marginalization and disadvantages in access to health services, health impacts, prevention/control of infectious diseases of poverty.	By 2023, two research studies implemented and evidence generated to inform policy and practice (four in the US$ 50 million scenario) *Progress made:* ▪ *Research studies implemented in Bhutan, Kenya, Malawi and South Africa.* ▪ *Three journal papers from Uganda and Nepal on completed projects on the application of intersectional gender analysis in TB and lymphatic filariasis research.*
Research for innovation	
1.1.5 Directions for development and accelerated access to new tools and strategies: i) outputs of TDR research projects, TDR staff and adviser expertise used to provide directional perspective for R&D for new tools (including advice/support to R&D sponsors), as well as new ways of implementing tools; ii) generic protocols to address IR issues encountered by different disease control programmes; and iii) strategy development, implementation and monitoring.	By 2023, at least four R&D initiatives informed by TDR research project output or TDR staff/adviser expertise. *Progress made:* ▪ *Expert advice provided to development of moxidectin for onchocerciasis elimination.* ▪ *Generic protocols/toolkits developed for treatment decision algorithms for Child TB treatment (TDA4Child).* ▪ *Document of best practices for vector control in built-up development areas, to be released in early 2024.*

Expected Results – Research for implementation	
Expected results and deliverables	***Indicators and targets***
1.3.10 Urban health interventions for the prevention and control of vector-borne and other infectious diseases of poverty: i) evidence from literature reviews on urban health, gender dimensions of infectious diseases and social determinants in urban settings analysed; and ii) research uptake activity in terms of evidence briefs for policy generated.	By 2023: • Journal papers published following literature reviews conducted by *icddr,b* in Bangladesh and the Regional Medical Research Centre in India. • Systematic reviews on infectious diseases among the urban poor during COVID-19 pandemic with a focus on gender and health inequities in urban slums. *Progress made:* ▪ *Four systematic reviews published in the domain of urban health and a fifth one submitted to a peer-reviewed journal. Two evidence briefs for policy completed in 2023.*
1.3.14 Testing of innovative strategies for vector control: i) evidence SIT effectiveness against vectors and arboviral diseases; ii) global map of the vector control technologies currently used and how new technologies can be integrated into the programmes; and iii) capacity building in medical entomology to improve vector control support globally.	By 2023: • At least four countries having performed field tests for SIT and evidence available. • A landscape analysis for the integration of innovative vector control technologies within the current ones available. • Global online directory for courses on medical entomology available and updated. • Scientific publications in open access peer-review journals. *Progress made:* ▪ *Two countries started SIT field tests by end of 2023. One country will follow in 2024.* ▪ *SIT training workshop held in Tahiti in May 2023.* ▪ *Scientific publications from the workshop presentations and discussions will be released in a special issue planned for early 2024.* ▪ *SIT technology presented at WHO VCAG in September 2023 for WHO recommendation.*

Expected Results – Research for implementation	
Expected results and deliverables	***Indicators and targets***
Research for integrated approaches (closing workstream)	
1.3.11 Multisectoral approach for prevention and control of malaria and emerging arboviral diseases: i) Documentation for training stakeholders from national malaria and other VBD control programmes on how to implement an MSA for disease control available; ii) new case studies implemented on vector-borne disease control in several countries; and iii) collaboration with sectors other than health to prevent and control vector-borne diseases well established.	By 2023: • Ten countries having received and used the training documentation. • Three countries with MSA approach against malaria initiated. • Three countries with MSA approach against arboviral diseases initiated. • Lessons learned report from collaboration with WHO's Water, Sanitation and Hygiene (WHO–WASH) group is available. • Scientific publications in open access peer-review journals. *Progress made:* ▪ *Thirteen countries have received and used the training documentation: Benin, Brazil, Burkina Faso, Cameroon, China, Ecuador, Ghana, Niger, Nigeria, Mali, Senegal, the United Republic of Tanzania, Zambia.* ▪ *Seven countries implemented MSAs against malaria: Benin, Burkina Faso, Nigeria, Mali, Senegal, the United Republic of Tanzania, Zambia.* ▪ *Two countries implemented MSAs against arboviral diseases: Brazil and Ecuador.* ▪ *Information briefs from case studies available for nine countries. Training materials on MSAs available and training workshop held in Senegal in September 2023.* ▪ *Module 1 of MOOC on MSAs available online.* ▪ *Scientific publications in process.*

Evolution of ERs across strategic plans



Progress description in 2023 and plans for 2024–2025

The following describes progress on the four research workstreams by expected results.

Research for policies (ER 1.1.1, ER 1.1.4, ER 1.3.3)

Research for implementation (ER 1.1.7, ER 1.2.1, ER 1.2.6, ER 1.3.12)

Research for innovation (ER 1.1.5, Er 1.3.10, ER 1.3.14)

Research for integrated approaches (ER 1.3.11). This ER will close on 31 December 2023 and will be replaced in 2024–2025 by ER 1.3.15. Refer to the section on Strategic Development Funds for information concerning how ER 1.3.15 has started its implementation.

▪ *Workstream: Research for policy*

Identifying which interventions can be translated into policy and go into practice

Support will be provided to countries and regions in: i) assessing the safety of interventions and identifying factors influencing their effectiveness; ii) developing systems for the prevention, early detection and containment of AMR; iii) accessing baseline information for the deployment of vector control activities; iv) conducting situation analyses and systematic reviews; and v) promoting new approaches for improved use of existing tools and interventions.

ER 1.1.1 : Country preparedness for disease outbreaks

This ER addresses an important public health problem: devastating outbreaks and their prediction, early detection and response. Considering the growing importance of *Aedes*-borne diseases, the initial focus was on dengue, chikungunya, Zika and yellow fever. Focus has slowly shifted towards also addressing other climate-sensitive diseases such as meningitis, cholera outbreaks and promoting a One Health approach.

For this expected result, TDR is providing the following:

1. Support to country control programmes worldwide to identify signals of impending arbovirus outbreaks, which has led to a model contingency plan and an Early Warning and Response System (EWARS) for arbovirus outbreaks;
2. Support to the Ethiopian National Disease Control Programme to conduct an EWARS pilot for predicting meningitis outbreaks; and
3. The strengthening of surveillance and control of arboviral diseases in Africa, including yellow fever outbreak prevention and response in high-risk African countries.

Progress in 2023

1. Early Warning and Response System (EWARS) for arboviral diseases

Current status of EWARS use:

- Full integration of EWARS into the national surveillance platform in Mexico, with 137 endemic municipalities. Because of changes within the Ministry of Health (MoH), the surveillance system was blocked, but with the nomination of a new head of the disease surveillance department it was recently restarted. A paper on the EWARS Mexican experience was developed with the team to explain how they moved from research to national implementation.
- Countries which started EWARS pilots in some districts, for later inclusion into the national surveillance system, are: Bangladesh, Cambodia, India, Lao People's Democratic Republic, Myanmar, Nepal, Thailand, Timor Leste, Colombia, Oman, Ethiopia, Malawi, Mozambique.
- Countries which had advanced with widespread use of EWARS but were slowed down due to political changes and are now coming back: Dominican Republic (for which additional support is provided by WHO PAHO), Sri Lanka (on hold since recent political events), and Malaysia (still on hold because of political reasons).
- There are countries where the implementation is on hold due to political reasons, e.g. Brazil.

The Environment, Climate Change and Health Department (WHO–ECCH) is collaborating on the implementation of EWARS in the following countries: Bangladesh, Cambodia, Lao People's Democratic Republic, Myanmar, Nepal, Timor Leste, Ethiopia, Malawi, Mozambique and Oman.

Since 2020, monthly calls to all teams provide progress on country experience and, when appropriate, also provide online training webinars. These are organized every six months with all EWARS-implementing countries, in collaboration with WHO–ECCH. In November 2023, a face-to-face meeting was organized for EWARS-implementing countries in South-East Asia and the West Pacific regions (eight countries). The objective was to maintain a dynamic, share experience and innovations concerning the use of EWARS. For example, the Lao People's Democratic Republic is piloting the integration of the District Health Information Software (DHIS2) and EWARS, and Thailand is piloting an application that can send EWARS alerts to the community. Further discussions are planned on country collaborations and cross-border activities for outbreak detection and response, with a view to focus beyond the existing classic surveillance/response and use a One Health approach to increase effectiveness of the vector control.

Fig. 1. Pilars of the Global Arbovirus Initiative and contribution of EWARS

EWARS for arboviral diseases was presented at the last Technical Action Group (TAG) meeting of the Global Arboviral Initiative (GLAI). EWARS fits with pillars 1 and 2 of the GLAI strategy. The TAG recommended that EWARS be integrated into the arbovirus dashboard that is under development by the GLAI. EWARS moved forward with this recommendation and it was presented at the November 2023 meeting mentioned above as a platform for integration into the global surveillance dashboard. It is anticipated that one or two countries from the region will be interested in piloting this integration, with the GLAI providing funding.

Focus on Colombia and Thailand

Both Colombia and Thailand were selected through a call in 2021 for conducting an evaluation of the feasibility of EWARS for predicting the occurrence of dengue outbreaks, early response, and its effectiveness on vector control. The studies are ongoing and were to be completed by end 2023. On a visit to Thailand, progress and the commitment of CDC Thailand was noted for piloting and scaling

up EWARS for arboviral diseases. On top of TDR's financial support (mainly for the IR project), the programme benefits from the involvement and financial support of CDC Thailand which facilitates the scale-up.

Increased communication around EWARS

During the visit to Thailand, each step of EWARS implementation was filmed. Interviews with users were conducted with the aim of developing a short documentary on EWARS to better promote this tool (documentary is under development). Additionally, a policy brief and a fact sheet on EWARS was developed (see Annex 1) to summarize its key features. EWARS presentations also took place at both WHO regional and TAG meetings. This increased interest from the GLAI and WHO regional offices (SEARO and WPRO). The PAHO region also expressed interest in collaboration to integrate EWARS into the Latin American platform for dengue surveillance, for which it will lead the deployment.

2. EWARS for other climate-sensitive diseases such as meningitis

This is a new area of work for which there is a lot of potential. EWARS is being tested in Mozambique for predicting cholera outbreaks, led by WHO–ECCH. TDR is supporting Ethiopia for use of the EWARS platform for predicting meningitis outbreaks and the first results are very encouraging. A visit in November 2023 reviewed and assessed next steps toward potential collaboration and support (e.g. with Africa CDC) for a wider use of EWARS in Ethiopia, and potentially elsewhere in sub-Saharan Africa.

3. Strengthening arboviral disease surveillance and vector control in Africa (including yellow fever)

- In 2022, **a cross-sectional survey** was conducted to determine the capacity of the 47 countries in the WHO African region for the surveillance and control of arboviral diseases. The report is now published[2] and efforts are going forward to address some of the gaps highlighted by the survey.
- Collaboration with the vector control department of AFRO resulted in the submission of a **proposal to the pandemic fund** to strengthen surveillance systems, including integration of EWARS for arboviral diseases in 12 African countries. Though this proposal was not successful, other opportunities will be pursued.
- A **manuscript focusing on gaps of the surveillance and outbreak response in Africa** is being developed with the aim to serve as an advocacy document on top of the full report already published.

New collaboration with the **Eliminate Yellow Fever Epidemics Strategy** will address the challenges of outbreak prevention and response gaps in high-risk African countries. In response to large outbreaks in Angola and the Democratic Republic of the Congo in 2016, and with the threat of international spread (11 cases were exported to China), the WHO, the Global Alliance for Vaccines and Immunization (GAVI) and UNICEF developed a comprehensive multi-partner global strategy to Eliminate Yellow fever Epidemics (EYE) 2017–2026, with three objectives: 1) protect at-risk populations; 2) prevent international spread; and 3) rapidly contain outbreaks.

Because of TDR's growing experience in the development of generic research packages (see ER 1.2.6), the EYE Secretariat proposed support to TDR for the development of a research package on yellow fever outbreaks in African countries. The objective is to provide guidance on conducting root-cause analyses of yellow fever outbreaks to countries with a history of preventive mass vaccination campaigns – as well as identifying reasons for vaccine response delays. The guidance will include template research protocols, including standard operating procedures (SOPs) and data collection tools.

[2] WHO. *Surveillance and control of arboviral diseases in the WHO African Region: Assessment of country capacities, 2022. Available at:* https://tdr.who.int/publications/i/item/9789240052918.

The research package is under development and will have two research protocols, questionnaires, and guidance documents for conducting the surveys in French and English. An available first draft was foreseen for September 2023. Regular meetings with the EYE Secretariat and AFRO's emergency department will continue discussions on methodology and data collection tools. A presentation of the research package will be made to the vaccine delivery working group (composed of a vaccine expert, representatives from GAVI, UNICEF, WHO and other stakeholders) and the risk analysis working group of the EYE Secretariat.

The research package was piloted in Guinea in October 2023 with key officials and counterparts from other pre-identified countries based on priority and feasibility criteria. These are: Cameroon (November 2023), Central African Republic (February 2024), and Côte d'Ivoire (February 2024) for the full research package, and Niger (if possible) for the investigation of the reasons for delays in vaccination only. During the piloting period and field visits, the TDR consultant will conduct on-the-job training for African consultants to be able to provide future support to their neighbouring countries. TDR will be involved in providing distance technical support to those countries for data collection and analysis when the implementation of the research package is carried out. The research package should be finalized in March 2024 and will be made available in French and English on the EYE Strategy and TDR websites.

Remaining risks and challenges

Remaining challenges in some countries relate to the scale-up of the EWARS-csd[3] tool nationwide, as this requires a dedicated server and multisectoral close collaboration, especially with national meteorological services. These aspects were discussed during the regional meeting on arboviral disease surveillance and EWARS-csd that was organized in November 2023 in Bangkok.

Contributions towards TDR key performance indicators

Partnerships and collaborations: Ministries of Health and/or National Institutes of Health in Brazil, Colombia, Dominican Republic, Ethiopia, India, Malaysia, Mexico, Mozambique, Sri Lanka and Thailand. GLAI – Global arbovirus initiative and AFRO, SEARO, WHO–ECCH, and the WHO Yellow Fever Department, Eliminate Yellow Fever Epidemic (EYE) Secretariat.

AFRO and all 47 WHO country offices, TDR, WHO–NTD, WHO–PHE and the WHO Emerging Diseases and Zoonoses Unit which is in charge of coordinating the Global Arbovirus Initiative. Also included are national Ministries of Health and the West Africa Health Organization.

Leverage created by this project: Work on yellow fever on root cause analysis generic protocol, and support to EWARS+ in countries through GLAI.

Gender aspects and vulnerable populations: None

Training: Integration of EWARS into district/national arboviral disease surveillance platforms.

Strengthened institutions and/or networks: This includes: i) disease surveillance departments where EWARS is implemented; ii) disease surveillance and vector control departments in 47 African countries; and iii) strengthening the West African network of reference laboratories for arboviral disease. These institutions were strengthened through regular virtual trainings on EWARS-csd and webinars on arboviral diseases.

Publications: Two policy briefs and a manuscript documenting the experience of Mexico with the integration of EWARS in their national surveillance system, from research to practice, has been published.

Results dissemination and uptake:

EWARS uptake at various stages of piloting in over 13 countries.

[3] Early Warning Response System for climate-sensitive diseases.

Plans for 2024–2025

Preparedness against outbreaks and pandemics is one of the key priority areas of the new TDR strategy. The original focus of this ER was on EWARS implementation against arboviral diseases and support for uptake by national programmes. TDR will continue to expand the reach of EWARS and collaboration with stakeholders across sectors and at national, regional, and global levels. In addition, efforts will be undertaken to explore how to consolidate evidence from lessons learned and identify opportunities and strategies for improved preparedness and rapid response to outbreaks, including other diseases. Further research will be supported to strengthen surveillance systems, community engagement and multisectoral responses.

ER 1.1.4: Country resilience to the threat of drug-resistant infections

Maximized utilization of data for tackling antimicrobial resistance to tackle drug-resistant infections through Structured Operational Research and Training IniTiative (SORT IT) in Africa, Asia and Latin America

The **Structured Operational Research and Training IniTiative (SORT IT)** is a global partnership-based initiative led by TDR, the UNICEF/UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases.

In January 2019, the United Kingdom of Great Britain and Northern Ireland provided designated funding (£8 212 943) for a SORT IT project on tackling antimicrobial resistance (AMR). The aim of this programme was to build sustainable operational research capacity to generate and utilize evidence to tackle the emergence, spread and health impact of AMR. Targeted countries are: in Africa – Ghana, Liberia and Sierra Leone; Asia – Nepal and Myanmar; and in Latin America – Colombia and Ecuador.[4]

Key success indicators: research implementation, capacity building and collateral benefits to health systems

Achievements since 2019	**99** research studies completed in seven countries	**97** published articles and three editorials (by Dec 2023)
79% of research had an impact on policy and/or practice	**74** implementing institutions became part of the AMR–SORT IT partnership	**28%** of AMR trainees became mentors after one training cycle
92% of trainees are applying SORT IT acquired skills to tackle AMR	**55%** of trainees are applying SORT IT acquired skills to emerging infections (COVID-19)	**62%** of trainees completed a new research study

[4] For more on AMR-SORT IT, go to https://tdr.who.int/activities/tackling-antimicrobial-resistance.

Progress in 2023

In 2023, the SORT IT project made tangible achievements in generating evidence and impact in tackling AMR. Through the process, the project also built sustainable research capacity, expanded global partnerships, and developed innovative models and approaches that are now being franchised.

The overall outputs demonstrate not only what can be achieved through an effective approach, but also highlight the need and expectation from countries for such important work to continue. The pioneering role played by TDR in tackling AMR has been visible in countries and the regions. The outputs are broadly categorized as: 1) research impact; 2) rapid publication of high-quality policy/practice-relevant research; 3) improved research communication; 4) research capacity building; 5) contributing to broader health system resilience; and 6) LMIC-equitable research partnerships.

1. *Research has impact and strengthens health systems against AMR and COVID-19*

A staggering 86% of all applied research globally does not influence policies, interventions and practice. By demonstrating impact, SORT IT is a front-runner in changing this paradigm. Of the first 60 SORT IT studies that were assessed for impact, 79% influenced policy and/or practice at national, regional and health facility levels. Regarding collateral benefits to the health system, 92% of trainees applied their SORT IT skills to AMR practice and 55% to tackling emerging infections. Furthermore, 62% of trainees completed a new research study and 28% of those trained became mentors which is testament to the effectiveness of the SORT IT model and its legacy of empowering future leaders in health research. A case example from Sierra Leone was presented to TDRs Joint Coordinating board by Dr Leno Amara increasing visibility of TDR and donor supported work.[5]

Table 2. Brief stories of research impact from Ghana, Nepal and Sierra Leone

(Please see Supplementary File for the full stories)

Research title	Research impact
Improved data quality on antibiotic use in a rural veterinary clinic following operational research in Ghana[6]	Recording of the diagnosis of animal diseases improved from 47% to 90% and the type of antibiotics prescribed from 53% to 77%.
Research evidence put into practice improves antibiotic use during surgery in Dhulikhel Hospital, Nepal[7]	A hospital guideline was developed and health workers were trained on improving antibiotic use during surgery. Overall compliance on antibiotic use increased from 75% to 85%.
Improvement in infection prevention and control performance following operational research in Sierra Leone[8]	IPC performance improved from intermediate (58%) to advanced (78%) levels in the national IPC unit and from basic (50%) to intermediate (59%) levels in hospitals.

[5] A pioneering SORT IT aimed at assessing field-level impact of previous SORT IT research studies was completed and published. Available at: https://www.mdpi.com/journal/tropicalmed/special_issues/7F8T7R680I.

[6] Cletus Kubasari et al. Quality of data recording and antimicrobial use in a Rural Veterinary Clinic in Ghana following an operational Research conducted in July 2021 (under peer review, TMID).

[7] Indira Shrestha et al. Surgical Antibiotic Prophylaxis Administration Improved after introducing Dedicated Guidelines: A Before-and-After Study from Dhulikhel Hospital in Nepal (2019–2023) (under peer review, TMID).

[8] Senesie Margao et al. Improvement in Infection Prevention and Control performance following operational research in Sierra Leone: A Before (2021) and After (2023) Study (under peer review, TMID).

> *"If research is to have impact and improve outcomes, it must be locally relevant and the findings actionable to shape policy and/or practice. SORT IT is well designed and invaluable for this purpose."*
>
> *Dr Sartie Kenneh, Chief Medical Officer, Ministry of Health and Sanitation, Sierra Leone*

2. *The SORT IT impact in Sierra Leone was highlighted by the WHO Directors-General's Office*

The SORT IT approach in Sierra Leone was considered as an exemplary example of multilevel collaboration and impact on tackling AMR. Those trained in Sierra Leone have since secured independent funding from the Canadian Government and are running franchised SORT IT trainings. This is a testament to the effectiveness of the SORT IT model and its legacy of empowering future leaders in health research. To promote sustainability, there are ongoing efforts by the Ministry of Health and Sanitation to integrate SORT IT within the curriculum of the University of Sierra Leone.

3. *High quality, policy/practice relevant research was rapidly published*

Ninety-nine priority research studies from the human, agricultural and environmental sectors (including One Health) were completed and 97 were published in a record median time of 10 weeks after submission, without compromising rigorous peer review. Such expedited peer-reviewed publications aim to ensure timely evidence for decision-making. This was achieved by: i) proactively accelerating the journal processes; and ii) providing structured support to the researchers, to promptly respond to editorial requirements and peer review. Such expedited peer-reviewed publications aim to ensure timely evidence for decision-making. Publication links are available under TDR key performance indicators.

4. *Research capacity of new trainers from the South was built*

Research capacity was built through training of research teams working together. Each research team was comprised of frontline workers and programme staff, SORT IT alumni, academia, WHO country office staff. The average number of individuals trained per research study was 3.2 with a total of 235 individuals trained.

> *"The SORT IT programme has helped build a critical mass of trained researchers who are embedded within the human, animal and plant health systems. Early-career researchers and decision makers have benefited, and so too have the health systems. We are now making efforts to embed SORT IT in the University of Sierra Leone."*
>
> *Dr Joseph Sam Kanu, AMR country coordinating platform, Sierra Leone*

5. *Effective research communication through a KISS – Keep It Short and Simple was implemented*

Trainees continued to benefit from training on effective communication of research findings, maximizing the opportunities for research uptake. This is now an embedded aspect of SORT IT trainings. Lightning videos are linked with publications on the journal sites. This is a pioneering step to further enhancing dissemination to decision-makers.[9]

[9] Outputs can be accessed at: https://tdr.who.int/activities/sort-it-operational-research-and-training/communicating-research-findings

Table 3. SORT IT Tools for effective communication of research findings

Tools	Purpose
1. Communication plan	To target decision-makers and stakeholders
2. One-page plain language summary	Key messages are kept short and simple
3. PowerPoint presentation (10 minutes) and a lightning presentation (3 minutes)	For conferences and national decision-makers
4. Elevator pitch (1-minute oral presentation)	For one-to-one conversations with busy decision-makers

> *"The SORT IT training on research communication is vital to present research findings in a simple manner. It allows decision-makers to easily grasp the key messages and take action to improve public health."*
>
> *Dr Mohammed Vandi, Director of AMR and health emergences, Sierra Leone*

6. *Broader support to countries for building health systems resilience.*

There was continued support to countries which galvanized the AMR committees and boosted TDR's capabilities to strengthen health system resilience to tackle not only AMR, but also COVID-19, influenza and Ebola. Financial support was provided for human resources (e.g. salary support for SORT IT technical officers and research fellows) and to hold meetings of technical working groups, and research dissemination events.

Table 4. Examples of building health systems resilience in countries

Health system area	Type of health system resilience built
Integrated AMR surveillance	Good surveillance data is essential to feeling the pulse of AMR in countries. Data quality of the Global AMR Surveillance System (GLASS) and integrated monitoring of antibiotic resistance in humans, animals and the environment continued. A public-private partnerships framework for animal health was launched
Quality of laboratory testing	Supply of essential laboratory reagents and consumables and trainings needed for AMR, COVID-19 and pandemic influenza was ensured in Ghana, Myanmar, Nepal and Sierra Leone. National quality assurance programmes were established, preparing countries for future pandemics.
Making health facilities safer	Infection prevention and control and hand hygiene improved in countries, keeping patients, their families and health workers safe, and contributing to the quality of healthcare delivery. National IPC strategies were also developed.

7. *Global collaborations and partnerships to tackle AMR have expanded.*

The AMR–SORT IT network was expanded to 74 implementing partners in 30 countries in Asia, Africa, the Americas and Europe making it now the largest partnership of AMR institutions in the world. Eighty-one percent of these institutions are from the South. Close collaboration was maintained with WHO regional and country offices and AMR coordinating committees. Synergistic collaborations with the Fleming Fund projects were established in Ghana, Nepal and Sierra Leone.[10]

[10] More on partner institutions at: SORT IT operational research and training (who.int).

Remaining risks and challenges

Research impact assessments are normally done 12 to 15 months after study completion, and for studies completed in 2023 from Colombia, Ecuador and Ghana, this will need to be done in 2024/2025. As designated funding for the AMR-SORT IT programme ended in June 2023, TDR will continue to continue this work using UD funds.

There is considerable thirst from countries for expanding the AMR work. New funding opportunities will be explored to continue this important work on AMR.

Contributions towards TDR key performance indicators

Partnerships and collaborations: Through SORT IT, the AMR collaborative network was expanded to include 73 implementing partners in 30 countries from Asia and Africa. Eighty per cent of the mentors involved with trainings are from the South and 43% are SORT IT alumni embedded within these institutions. This has boosted high-income country and LMIC partnerships, as well as LMIC–LMIC, partnerships; promoted equitable research; and built new communities of practice to tackle AMR at a global level. A list of partner institutions is available at: the SORT IT website.

Leverage created by this project: The project budget was about US$ 10 million from the UK Department of Health and Social Care, and ended in June 2023. A project extension was leveraged, valued at US$ 800 000 for 2023. TDR will build on the project success stories to mobilize new funding.

Gender aspects and vulnerable populations: Of 99 research projects completed, 48% of the principal investigators are women. Through the selection process, gender and geographic equity was promoted as well as in-country leadership as demonstrated by 100% first authorship from LMICs. The SORT IT-AMR programme is focused on LMIC countries where the burden of AMR is high, particularly for the rural poor who have limited access to antibiotics and to health facilities. Vulnerable groups were specifically targeted as priority topics with several research projects focused on neonates and women. Topics related to One Health, such as improving water quality, waste management, and rational antibiotic use in animal husbandry, which will have a wide benefit on the lives of poor communities. Focused attention on cross-border AMR activities in Colombia and Ecuador target vulnerable populations. Of all the AMR studies, 78% had an impact on policy and practice implying benefit (direct or indirect) to health systems and the populations they serve.

Training: The AMR-SORT IT model uniquely combines research training, research implementation and a total of 235 health workers were trained. In addition, 12 trained operational research officers were embedded in WHO country officers and provide broader support to health systems strengthening and research activities at country level. To increase value for money, each research project includes four layers of training (training-of-trainers): 1) healthcare workers, veterinary and environmental officers; 2) SORT IT alumni; 3) academia; and 4) WHO country office staff. The average numbers trained per research project is three.

Strengthened institutions and/or networks: Through the AMR project, the SORT IT partnership was strengthened with 74 institutional partners working together in 30 countries. There have also been new mentors, and new SORT IT alumni working with several WHO county offices. SORT IT is now the largest partnership of institutions who conducted implementation research globally and AMR hubs exist in Ghana, Nepal and Sierra Leone where independent work on SORT IT is continuing as well as the engagement with research institutions.

Publications: By December 2023, there were a total of 97 cumulative publications on AMR of which 22 were in 2023 (see Annex 1).

In collaboration with journals, 3-minute lightning videos were linked to published papers on journal websites. Publications from Latin America were in both English and Spanish. Additional outputs, including Communicating research findings with a KISS – Keep It Short and Simple, can be accessed at: https://tdr.who.int/activities/sort-it-operational-research-and-training/communicating-research-findings.

Results dissemination and uptake: Effective communication of research is now an integral part of the SORT IT training programme. Of competed research, there is a 79% uptake in policy and practice. See the main report for more details. Please see evidence summaries of completed AMR research at: https://tdr.who.int/activities/sort-it-operational-research-and-training/communicating-research-findings.

Plans for 2024–2025

In close collaboration with WHO country offices, new initiatives will be supported and linked to tackling AMR, the remit of which would depend on the availability of funds. Where possible, hubs will be created in countries that were front-runners in the first phase of the AMR project (Ghana, Sierra Leone and Nepal) to propel new countries into tackling AMR. The AMR programme in the EMRO region will be extended.

Please see Supplementary File for Success stories, list of publications and pictures.

ER 1.3.3: Population health vulnerabilities to vector-borne diseases: increasing resilience under climate change conditions

This Expected Result (ER) is about generating evidence to enable the development of innovative strategies to reduce VBD-related human vulnerability and to increase resilience of African populations to VBD-related health threats with using a One Health approach. It aims to broaden and extend knowledge, research capacity, collaboration and policy advice products that can be used throughout Africa and other regions. Operationalizing One Health combines well-documented, evidence-based principles and practices that specifically address the problem of population's vulnerability. It is widely agreed among international development agencies, medical and public health scientists that One Health can contribute significantly to global health in this regard.

In July 2022, a joint call for proposals was launched by TDR in collaboration with WHO-NTD, focal persons for climate and Health and for One-Health approach of the regional office of the WHO for Africa for consortiums of collaborating institutions in Africa to address One Health implementation research priorities for VBDs in the context of climate change.

Progress in 2023

1. Conduct of the four selected proposals
2. Conduct of One Health and VBD webinars
3. Update of TDR website
4. Collaboration with quadripartite action (with WHO–ECCH and One Health regional instances)

1. **Conduct of four selected projects:**

Fourteen projects were received and reviewed by a panel composed by external experts and TDR team. In November 2022, four research proposals were selected and initiated to address One Health implementation research priorities for VBDs in the context of climate change in Africa.

Project 1: Strengthening surveillance of leishmaniasis in Uganda and Kenya through a collaborative multisectoral One Health capacity building approach in endemic foci (Uganda and Kenya)

This study is conducted by the Makerere University, the University of Nairobi, Africa One Health University Network (AFROHUN) Uganda and the Kenya Medical Research Institute (KEMRI). This study aims to identify leishmaniasis hotspots and decipher the **risks and climate factors associated with the disease within endemic foci** using retrospective passive and active screening data in humans and animals, as well as climate data.

Project 2: Enhancing One Health surveillance and control of vector-borne diseases related to climate change in the West Africa region (Senegal and Nigeria)

This study is conducted by the Institute Pasteur Dakar (IPD) and the Nigerian Institute of Medical Research (NIMR). The study aims to jointly undertake mixed retrospective-prospective research to determine the **effect of climate change on mosquito borne disease emergence, outbreaks and spread in Senegal and Nigeria** and establish a process for the systematic translation of strategies for prevention, preparedness, and response, which can then be extended to other parts of West Africa.

Project 3: One Health approach to controlling and understanding the dynamics of fascioliasis and schistosomiasis in the context of climate change (the United Republic of Tanzania and Rwanda).

This study is conducted by the Kilimanjaro Clinical Research Institute (KCRI), the Tanzania Plant Health and Pesticides Authority (TPHPA) and the University of Rwanda. The aim of this study is to **co-develop comprehensive One Health approaches in the United Republic of Tanzania and Rwanda to tackle the complex transmission-enabling environment of the snail-borne trematodiases around fresh water sources**.

Project 4: Application of a One Health approach for reducing the burden of vector-borne diseases in vulnerable communities in the context of climate change (South Africa and Rwanda)

This study is conducted by the University of Kwazulu-Natal and the University of Global Health Equity. The aim of this study is **to develop metrics, a One Health implementation guide and a collaborative platform for the evaluation of One Health-based schistosomiasis prevention and control projects.** The study builds on previous models and will develop novel One Health operationalization metrics relevant for the prevention and control of schistosomiasis in the context of climate change among vulnerable communities. The findings of this exercise will be applicable to a broader range of One Health and VBD settings. The collaborative platform will strengthen partnerships among African scientists and research institutions in the field of One Health for the prevention and control of VBDs in the context of climate change among vulnerable communities in Africa.

2. **Conduct of One Health and vector-borne diseases webinar series**

This webinar series was created as an online network of researchers and others working in the field of VBDs. This webinar series aimed to provide a platform that allows for sharing of relevant research, lessons learnt, ideas, innovation, and fosters collaboration. Individuals came together to discuss various relevant research themes around one health, climate change and VBDs.

Two webinars were conducted so far:

- The first webinar aimed at introducing all four of the above-mentioned projects and at discussing challenges and ideas for implementation. It was organized in March 2023. A total of 33 persons participated from WHO (TDR), WHO, AFROHUN, Bindura University of Science and Education,

Institut Pasteur de Dakar (IPD), KEMRI, KCRI, Makerere University, Nigerian Institute of Medical Research (NIMR), TPHPA, University of Global Health Equity, University of KwaZulu-Natal, University of Nairobi, University of Rwanda .

- The second webinar was organized in May 2023, in which 38 participated. This seminar was organized in collaboration with the WHO–NTD department. The objective was to discuss the health joint plan of action to familiarize all with its six action tracks, with a special focus on action track 3 that focuses on zoonotic, vector-borne and neglected tropical diseases. It was presented by Bernadette Abela-Ridder, WHO–NTD, who was also involved with the quadripartite during development of the plan of action. Discussions were focused on an understanding of One Health at a global level, as well as the challenges faced during uptake and implementation of an integrated inclusive multidisciplinary approach, at national as well as global level.

One Health online curriculum

An online One Health Operationalizing curriculum was developed, and pilot tested in Kenya with 23 participants within the collaborating consortia. Further development is anticipated addressing issues identified in the process. The One Health module is under development for the IR Toolkit and subsequently MOOC. The material is under external review coordinated by RCS in TDR.

Remaining risks and challenges

An area of focus is alignment of the ER with the TDR Strategic Plan 2024–2029 where emphasis is placed on mainstreaming a holistic, integrated One Health approach to implementation research. This will be addressed in the coming biennium of 2024–2025.

Contributions towards TDR key performance indicators

Partnerships and collaborations: At regional level, there is collaboration with WHO–ECCH and the One Health for Africa unit. At a One Health regional meeting in Africa (Q4 2023), the discussion included organizing the participation of the researchers/principal investigators (PIs) from each of the four One Health research projects to share the results on their projects.

Projects involve institutions in Africa: AFROHUN; Makerere University, Uganda; Ministry of Health, Uganda; University of Nairobi, Kenya; Daktari NGO Spain; Institute Pasteur Dakar (IPD); Nigerian Institute of Medical Research (NIMR); National One Health Committee Senegal; Kilimanjaro Clinical Research Institute (KCRI) United Republic of Tanzania; Tanzania Plant Health and Pesticides Authority (TPHPA); University of Rwanda; University of Kwazulu-Natal, South Africa; and University of Global Health Equity; Rwanda.

Leverage created by this project: None

Gender aspects and vulnerable populations: *Uganda–Kenya project:* The ratio of male to female investigators on the project is 5: 3. The project also involves women and other marginalized groups during the data collection process, training of frontline workers, and during the interview of community members to understand the gender influence or roles and related implications on leishmaniasis. The One Health course developed on Leishmaniasis includes a module on Gender, risk analysis and control of leishmaniasis in a One Health context. This module enables understanding of the gender concepts and their role in explaining leishmaniasis disease (its patterns/distribution, risk including climate change factors, and its control) in the One Health context. It reflects on how gender norms, roles and relations impact women and men's health and helps develop an appreciation of how gender intersects with other determinants of health. It also equips participants to plan for gender issues including gender-sensitive control and advocacy plans for leishmaniasis in the One Health context.

Senegal-Nigeria project: The ratio of male to female investigators on the project is 15:4. This study is inclusive of data of individuals of all gender and data analysis and considers appropriate sex-disaggregation. The team has also continued professional development for all research team members through completion of training course on Gender equality and sexual diversity and incorporated gender equality messaging in all its communication.

The United Republic of Tanzania-Rwanda project: The ratio of male to female investigators on the project is 6:2. For all project activities and engagement/stakeholder meeting, attention has been on ensuring contributor equity (i.e. in gender, religion, ethnicity and age groups). Frequent evaluation of the degree to which proposed procedures will affect equity, human rights and gender is being conducted throughout the study.

South Africa-Rwanda project: The ratio of male to female investigators on the project is 9:2. The study design considers how socially, and culturally ascribed gender roles and responsibilities contribute to failure by communities to reduce the burden of VBDs. In order to lessen gender disparities regarding access to and control over the project's resources and benefits, the project team includes community members and researchers who include women, young people, and non-conforming people in strategic positions of power, throughout the stakeholder consultation and data collection process.

Training: A *c*urriculum was created for a One Health course on Leishmaniasis by Makerere University, College of Veterinary Medicine, Animal Resources and Biosecurity and Centre for Biosecurity and Global Health. Frontline workers were concurrently trained. Under the Uganda-Kenya project, MSc students on the WHO-TDR project, laboratory technicians and Entomologists were trained in the diagnosis of leishmaniasis through ELISA diagnosis training and DNA extraction training.

Strengthened institutions and/or networks: None

Publications: Three

Results dissemination and uptake: Based on study results, the Maasai community changed their practice for vector control. The rest of the research projects are at a too early stage for uptake.

Plans for 2024–2025

- Finalization of all four research projects and TDR support for results dissemination through oral and written manuscripts.
- Continuation of the One Health and VBD Diseases webinar series with involvement of more One Health key stakeholders from the WHO African region such as Africa CDC, AFROHUN.
- It is planned to organise a symposium at the next World One Health Congress in 2024 where all the One Health projects results will be shared. During this symposium other TDRs research and initiatives undertaken under a One Health approach could be presented with highlighting their impact.
- The TDR website will be further updated.
- A literature database is being compiled of research undertaken regarding tick borne diseases.

The One Health approach is a priority focus area for TDR implementation research. It will be applied to study climate change related vulnerabilities and development of mitigation strategies.

▪ *Workstream: Research for implementation*

This workstream is about understanding how interventions that work in laboratory clinical trials and pilot settings can be transferred to real-life settings and scaled-up at the national level.

TDR applies this approach to disease prevention, control and elimination, and will identify practical impact measures for the research. TDR will also help countries generate the evidence needed for prompt and effective outbreak response. All interventions will take into consideration local governance, community involvement, financing and delivery arrangements, and the building of more robust health systems by integrating strategies and tools. TDR will work to increase community participation and mobilization, and build a body of evidence that supports the essential role of community health workers.

ER 1.1.7 Maximized utilization of data for public health decision-making

Maximized utilization of data for tackling emerging infections and infectious diseases of poverty through the Structured Operational Research and Training IniTiative

The **S**tructured **O**perational **R**esearch and **T**raining **I**nitiative (**SORT IT**) aims to make countries "data rich, information rich and action rich". SORT IT is a global partnership-based initiative led by TDR and aligns with the SDG-17.18 *generating high-quality, timely and disaggregated data for informed decision-making*.

Aim: Build sustainable operational research capacity to generate and utilize data for decision-making to improve public health in LMICs.

Scientific scope: Research priorities are tailored to country priorities. The TDR focus is on catalytic initiatives that will accelerate progress towards universal health coverage (UHC) and the Sustainable Development Goals (SDGs). The current focus is on tackling emerging infections and infectious diseases of poverty.

How: Strong engagement with WHO country offices, national stake holders and SORT IT partners in the evidence to action cycle. Performance targets are integrated to ensure quality.

Who: Health workers from all levels of the health system, including nurses, midwives, clinical officers, data analysts, policy-makers, community members, and those from the agricultural and environmental sectors (e.g. veterinary officers, environmental health workers).

Desired impact: Strengthened health systems, better programme performance and improved public health.

The SORT IT cycle: The SORT IT cycle englobes the entire evidence-to-action cycle from defining the most relevant research to uptake of the findings. SORT IT also embraces the "Train, Embed, Retain and Enable" philosophy for those working within health systems which is in line with WHO's Thirteenth General Programme of Work, 2019–2023.[11]

[11] More on SORT IT at: https://tdr.who.int/activities/sort-it-operational-research-and-training.

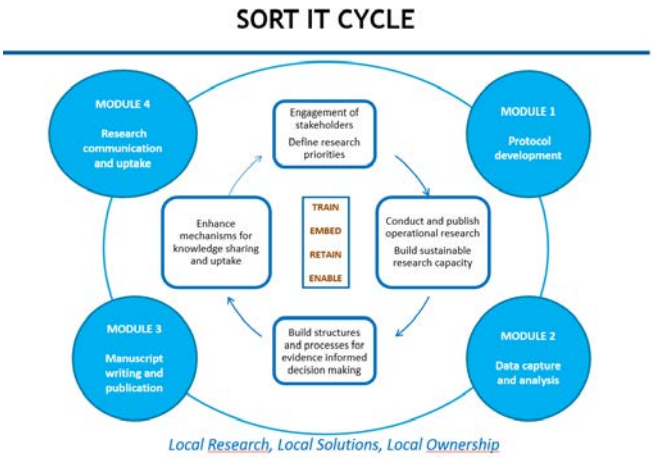


Fig. 2. The SORT IT research cycle

Key success indicators: coverage, capacity built and impact

Achievements since inception	**94** countries	**26** public health domains
74 implementing institutions in the SORT IT partnership	**51%** of trainees completed new research studies independently	**68%** of research had an impact on policy and/or practice

Progress in 2023

Progress was made in five key areas: 1) operational research and data sharing to tackle emerging infections; 2) improving care for vulnerable TB patients with disability; 3) reaching out to hard-to-reach populations with TB; 4) neglected tropical diseases in Africa and; 5) franchising the SORT IT model to tackle infectious diseases of poverty while also expanding global partnerships.

1. Emerging infections: Operational research and data sharing for emergency preparedness in West and Central Africa

Following the 2014/2016 Ebola outbreak, the most affected countries in West Africa provided their Ebola data to the Infectious Diseases Data Observatory (IDDO, based at Oxford). IDDO also manages a global database containing over one million patient records related to COVID-19.

In June 2023, a new SORT IT was started permitting health workers from the Democratic Republic of the Congo, Guinea, Liberia and Sierra Leone to use this initiative for data sharing, operational research and building partnerships at national, regional and global levels to strengthen health systems. Ten research projects were started involving surveillance, case-finding and clinical care – the pillars of outbreak management. This SORT IT acts as an exemplar for analysis of similar data in future outbreaks.

Further improvements are now needed to: a) tailor these sophisticated IDDO databases into formats that are user friendly for countries; b) integrate capacity building of the MOH as an integral part of

data sharing agreements; and c) include real-time data through use of newer digital technologies (e.g. EpiCollect5 cloud-based application installed on mobile phones) to generate real-time intel to steer the health system out of trouble during pandemics.

Fig. 3. EpiCollect5 cloud based application installed on mobile phones

1. *Vulnerable populations: Real-time implementation research for management of TB disability during and after tuberculosis treatment in four African countries*

One-in-four people who get tuberculosis (TB) also develop TB-associated disabilities due to the disease or its treatment, resulting in increased morbidity, mortality and compromised quality of life. Since 2014, the Stop TB Partnership's 90-(90)-90 coverage and treatment targets have provided benchmarks against which to assess TB programme performance.

In a recent article in the International Journal of Tuberculosis and Lung Disease, it was argued that a ''fourth 90'' should be added to ensure that 90% of all people with TB can have a good health-related quality of life.[12] Implicit in this argument for a ''fourth 90'' is the need for TB programmes to assess TB patients for TB-related disability and refer those who require further attention for appropriate care within the general healthcare system.

This project involves China, Kenya, Uganda, Zambia and Zimbabwe, as front-runners in paving the way to improve patient-centred care for TB disability. This a novel addition to the SORT IT menu and involves supporting NTPs set-up the patient assessment and referral systems to manage disability.

This project is innovative in four aspects:

1. Patients with TB will be assessed within the routine programme setting at the end of anti-TB treatment for co-morbidities, risk determinants and disability, those with identified problems will be referred for care and whether or not referral happens will be documented. Such patient-centred care rarely, if ever, occurs when patients have completed TB treatment.

2. The use of standardized SORT IT protocols on a large scale will generate powered data to inform national and global (WHO) policies on this subject.

3. Real-time data will be generated by using newer digital technologies (e.g. EpiCollect5 cloud-based applications installed on mobile phones), with the aim to ensure a robust feedback loop for data collection, validation and analysis.

4. TB survivors will be trained to assess and provide support to TB patients, and this may go some way to address healthcare worker shortages and ensure sustainability within NTPs.

[12] A.D. Harries et al. *Should we consider a 'fourth 90' for tuberculosis?,* The Union, Vol.23, No. 12, 2019, 1253–1256, Doi: 10.5588/ijtld.19.0471.

Fig. 4. (Left to right) the Fourth 90 as part of the Stop-TB targets; lung disability in a TB survivor; (below) Editorial in the IJTLD advocating for attention on TB disability

2. *Hard-to-reach populations: Accelerating progress for ending TB/MDR-TB in hard-to-reach populations through operational research*

Focused on accelerating universal health coverage and improving access and equity for hard-to-reach populations in Kyrgyzstan, this SORT IT initiative mobilized experts from 10 countries to support the NTP of the Kyrgyz Republic while also building South–South and North–South partnerships. A new unit for research and policy management has just been established in the NTP which opens a window of opportunity for institutionalizing research in the country and building a strong evidence base (and hub) for informing national and regional (WHO) policies.

Efforts are also underway to integrate the SORT IT programme into the medical and postgraduate curricula (including for MPH and PhD) of the University of Kyrgyzstan which will boost sustainability, embedding and visibility.

A total of 10 papers were published in a special issue of the *Tropical Medicine and Infectious Disease journal.*[13]

> *"I especially liked that through the SORT IT course I acquired many skills in a consolidated manner. The published articles that were the result of our joint work were very much appreciated by all my colleagues, and I have great believe they will make a significant contribution to informing policy and practice of the National Tuberculosis Program."*
>
> *Dr Konushbek Sakmamatov, Director Osh TB centre, Kyrgyzstan.*

3. *Neglected Tropical Diseases: Bridging the francophone research gap in Africa for UHC*

To accelerate UHC for NTDs, 21 policy relevant research studies on Neglected Tropical Diseases (and snake bite) are under implementation in francophone countries (Burkina Faso, Guinea, Mali, Niger and Senegal). Training materials have also been translated into French, allowing wider franchising in the region. A total of 16 manuscripts have been developed in French and translated to English for submission as a supplement in a peer-reviewed journal.

[13] Dr Ermias Diro and Dr Sven Gudmund Hinderaker, see Annex 1, under ER 1.1.7.

4. Continued SORT IT franchising and building global partnerships

SORT IT franchising continues using the trained pool of human resources (SORT IT alumni) and available tools such as standard operating procedures, video lectures, reporting metrics and curriculum which is now available in Spanish, Russian and French. Use of the SORT IT online training platform has reduced costs and improved efficiencies.

By December 2023, the SORT IT partnership reached 94 countries and includes 74 partner institutions in 30 countries. There are close to 1000 publications in five languages (English, French, Portuguese, Russian, Spanish) and covering 26 public health domains.

After one SORT IT cycle, about fifty-one of SORT IT alumni continued new research projects independently, which is evidence of the effectiveness of SORT IT in building sustainable operational research capacity.

Fig. 5. Geographic scale-up of SORT IT projects (2009–2023)

Remaining risks and challenges

One of the main risks is short term funding of one year or less which is too short for obtaining ethics clearances, ensuring adequate data collection and reporting. Donor negotiations are ongoing to secure longer term grants.

Contributions towards TDR key performance indicators

Partnerships and collaborations: TDR leads the SORT IT partnership which represents a worldwide collaboration of operational research involving implementing institutions around the world. There are 74 institutions involved in SORT IT from 30 countries, most of which are from LMICs. HIC–LMIC and LMIC–LMIC collaborations continue, and new communities of practice are ;being built at a global level ("thinking global, acting local"). This includes: WHO regional and country offices, academic institutions, nongovernmental organizations, and ministries of health. The list of partner institutions is available at: SORT IT operational research and training (who.int).

Leverage created by this project: US$ 1.2 Million. US$ 1 million was received from USAID, and roughly US$ 200 000 from Luxembourg.

Gender aspects and vulnerable populations: Participant selection processes continue to promote gender and geographic equity and LMIC first authorship in published outputs. In 2022, about 45% being trained were women. Vulnerable groups were specifically targeted (neonates, children, and women) as a priority for research topics wherever possible.

In terms of targeting vulnerable populations, the SORT IT programme focus is on NTDs, hard-reach populations, TB patients with disability and those affected by emerging infections and public health emergencies. These populations are also often more affected by poverty. In terms of geographic equity, expansion to Francophone Africa is under way as this is a recognized gap area. Paying attention to these geographic and socio-economic perspectives contributes to an equitable approach to programming. Roughly 68% of all SORT IT research has an impact on policy and practice and is thus beneficial to health systems and populations.

Training: In 2023, there were SORT IT trainings on: 1) emerging infections in Central and West Africa (10 projects); 2) managing disability (four African projects); 3) tackling TB/HIV in hard-to-reach populations in the Kyrgyz republic (nine projects); 4) on NTDs in Francophone Africa (12 projects); and 5) on research communication. The SORT IT model uniquely combines research training and implementation and builds communities of practice. Wherever possible, each research project is used to simultaneously implement four layers of training: 1) training of frontline workers and programme staff; 2) training of SORT IT alumni as trainers; 3) training of academia as trainers; and 4) training of WHO country staff as trainers. The average number trained per research study is three, which adds to the value for money. A total of about 100 were people trained in 2023.

Strengthened institutions and/or networks: The SORT IT partnership now includes 74 implementing partners and a network of close to 1000 alumni and 300 mentors who provide support to SORT IT implementation in countries. SORT IT hubs exists in Armenia, India, Zimbabwe, Guinee, Senegal, Sierra Leone, Burkina Faso and the Kyrgyz republic. These countries have enough SORT IT alumni and lead franchised SORT IT cycles.

Publications: Cumulatively since 2009, there have been 857 publications by the SORT IT partnership in 50 journals (impact factor 0.4–19) and in five languages (English, Russian, Spanish, Portuguese and French). In 2023, there were 33 publications. See Diro in Annex 1, under ER 1.1.7.

Results dissemination and uptake: Roughly 68% of SORT IT studies report an impact on policy and/or practice. Researchers now benefit from a new SORT IT training module on effective communication and dissemination of research findings which maximizes the opportunities for research uptake. Short lightning presentations are now integrated with publications on journal websites. Please see evidence summaries at https://tdr.who.int/activities/sort-it-operational-research-and-training/communicating-research-findings. Furthermore, we have also included impact assessment of research projects 15–24 months.

Plans for 2024–2025

- In close collaboration with WHO country and regional offices, TDR will continue to support "catalytic initiatives" linked to UHC and enhance TDR leadership, visibility and funding. Focus will be on public health emergencies and infectious disease of poverty, while proactively targeting hard-to-reach and vulnerable populations. The approach will involve democratizing research (local research, local solutions, local ownership) and is in line with the new TDR strategy 2026–2030.
- Where possible, existing hubs will be strengthened for operational research on marginalized and key populations and AMR in: Armenia with the Tuberculosis Research and Prevention and NGOs; Ethiopia with public health institutes and Africa CDC; Guinea with the University of Gamal Abdel Nasser; Burkina Faso with the African Institute of Public Health; with the Kyrgyzstan national TB programme; and Ghana/Nepal with AMR stakeholders.
- Depending on availability of funds, SORT IT will be expanded and franchised while ensuring quality standards.

Please see Annex 1 for list of publications and supplementary files for further details.

ER 1.2.1: Strategies to achieve and sustain disease elimination

TDR-managed research was critical for availability of the tools and strategies that have allowed for the inception and progress in the elimination of visceral leishmaniasis (VL) in the Indian subcontinent and onchocerciasis in Africa.

VISCERAL LEISHMANIASIS ELIMINATION IN THE INDIAN SUBCONTINENT

One of the longest and most successful implementation research programmes at TDR, these efforts have contributed to a sharp reduction of cases in all three endemic countries (from over 50 000 cases in 2007 to 1,577 cases in 2021). With further advance, the epidemiological profile in the countries keeps changing. In Nepal and Bangladesh (where TDR support is currently focused because India has other support, but is kept informed) new VL cases and foci are appearing in previously non-endemic districts.

Progress in 2023

New evidence on priority challenges of VL elimination has been generated and disseminated.

- Insecticidal wall painting (IWP) showed excellent performance against sand flies compared with indoor residual spraying (IRS) over a two-year period. IWP was also more cost-effective per household protected compared to IRS. It is recommended as the best alternative to IRS for programmatic use in vector control.
- The burden of PKDL is low in both Bangladesh and Nepal. More research is needed to identify the reasons for PKDL occurrence, particularly in cases without past history of VL.
- Effective implementation of the national strategy for follow up of treated VL cases requires addressing elements related to patients (childhood, awareness, transport, communication) clinicians (compliance) and organization of service delivery (training and deployment).
- COVID-19 disrupted vector control activities and active case detection. There was no added delay for VL diagnosis but treatment initiation and reporting times increased during COVID.

- Indigenous focal transmission of VL is occurring in new foci in Nepal. In Bangladesh, although no active cases were found among the screened individuals, asymptomatic cases were evident. Since sandfly vectors exist in these areas, the national programmes should consider these areas as VL endemic and initiate control activities as per guidelines. This has now been initiated in both Bangladesh and Nepal.

Ongoing projects in 2023

Decision-making for indoor residual spraying in post-elimination phase of visceral leishmaniasis in Bangladesh and Nepal

Indoor residual spraying (IRS) is presently recommended twice a year in endemic villages. When to stop IRS is not defined. The relationship between the frequency of IRS and occurrence of VL and vectors since 2012 is being investigated. Insecticide susceptibility will be tested.

Preliminary data analysis from Bangladesh suggest that sand fly density is similar in households that had received IRS and those that have not, suggesting no relationship between IRS and sand fly density. Socio-economic standards of endemic communities have meantime improved.

Micro-stratification of visceral leishmaniasis (VL) endemic areas to identify hotspots and disease shifting patterns in Bangladesh and Nepal

The epidemiology of VL has been changing. Nevertheless, VL remains a focal disease more prevalent among the poorest and marginalized communities within at risk geographic units. VL micro-stratification will provide strategic information on the actual population at risk of VL at village level**.** Ten year data on disease burden, ecology (receptivity) and vulnerability will be collected from various sources and analysed stratified by categories (as high, moderate, low or no VL). No preliminary analysis has been made so far**.**

Determination of the seroprevalence of HIV among VL patients in Bangladesh

The prevalence of VL-HIV coinfection in Bangladesh is unknown. Coinfected patients could serve as sources for new infections post-elimination. Treatment requires specialized facilities and combinations of drugs. Of 862 archived specimens, owners of 423 could be reached by phone; and 418 agreed to visit centre, with 298 tested on fresh samples so far and none positive. HIV-VL co-infection rate appears to be very low in Bangladesh.

VISCERAL LEISHMANIASIS ELIMINATION IN EAST AFRICA

The proportion of reported cases from East Africa increased from 10% to > 50% of the global total in the last 15 years, with a threefold increase in actual numbers in 2018 compared to 2007. VL endemic countries in East Africa have requested for WHO support. TDR is collaborating with WHO and other partners to initiate VL elimination efforts in East Africa.

Progress in 2023

Review of lessons learned from the kala-azar elimination program in the Indian subcontinent

Although direct attribution of disease decline to research outputs is difficult to establish, the experience of the regional kala azar elimination program in SE Asia assessed in a study in Nepal (and another in Bangladesh) demonstrated that IR can be a critical enabler for disease elimination. The lessons can potentially inform IR strategies in other countries with diseases targeted for elimination.

Stakeholder consultations on the regional VL elimination initiative for East Africa

WHO convened a stakeholders meeting in Nairobi on 24-27 January 2003 with over 90 participants including representatives of the Ministries of Health (MoH) from the eight VL-endemic member states in East Africa (Chad, Eritrea, Ethiopia, Kenya, Somalia, South Sudan, Sudan, and Uganda) to review the current epidemiological situation and draft a high-level VL elimination strategic framework for 2023–2030. Successful lessons were presented from South-East Asia including political commitment through the signing of a Memorandum of Understanding (MOU) among endemic countries of the region. A unanimous recommendation was issued to launch a VL elimination initiative as a public health problem in East Africa sub-region to reduce neglect, inequalities, and social and economic impact.

National Programme Managers and stakeholders launched the Nairobi Declaration on VL elimination in East Africa at the meeting. Senior leadership of the MoH agreed to reflect political commitment. WHO was requested to constitute an East Africa (WHO Regions of Africa and Eastern Mediterranean) technical advisory group to review progress and provide strategic directions for implementing the WHO East Africa VL elimination strategy in endemic countries.

Ongoing projects in 2023

Assessing programme capacities in VL-endemic countries in East Africa to implement an elimination initiative

The status of health system capacity in some high-burden countries in East Africa is unknown. Programme capacity assessment is essential for proper planning of the preparatory phase for VL elimination. A joint call for applications was issued with WHO–NTD to support the assessment of programme capacities, initially in three VL-endemic countries, Eritrea, South Sudan and Sudan. A team of investigators from East Africa were selected to conduct the review which will be coordinated across the three countries, using a common methodology, and working in collaboration with the respective national VL or NTD programmes and local researchers.

The team has received conditional approval from the WHO Ethics Review Committee, has developed study instruments and is in consultation with national programmes in Eritrea and South Sudan to proceed with assessment.

Evaluation of in vitro rapid diagnostic test kits for the East African setting

An important priority for the VL elimination effort is to identify the best rapid detection test (RDT) for the East African focus. TDR and WHO–NTD are working with the International Diagnostic Centre (IDC) Network at the London School of Hygiene and Tropical Medicine (LSHTM) and associated partners (the Global Health Impact Group, USA and Africa CDC). Preparations will be finalized for the comparative evaluation of the performance of commercially available rk39 RDTs in the diagnosis of VL in East Africa. This will include developing a common evaluation protocol for use at all evaluation sites, to select and prepare the evaluation sites with necessary approvals and contracts in place and completing evaluation plans to be followed in 2024.

Proposed activities in 2024–2025:

To support the programme capacity assessment in endemic countries and the comparative evaluation of the RDTs in the diagnosis of visceral leishmaniasis in East Africa; support new follow up studies in South-East Asia; organize, in collaboration with WHO and other partners, a research-focused stakeholders meeting to assess progress and identify priorities in both regional foci.

Remaining risks and challenges

These include inadequate research funding despite increased need of evidence to inform strategies in the last mile of elimination; decreased attention to VL elimination in South-East Asian countries as burden becomes minimal compared to other priorities, and continued civil conflict in the East African focus, with internal displacement and disruption of healthcare services.

Contributions towards TDR key performance indicators

Partnerships and collaborations: Public Health and Infectious Disease Research Center, Nepal; International Centre for Diarrhoeal Disease Research and the icddr,b; Epidemiology and Disease Control Division, Department of Health Services, Nepal; Director General of Health Services, Bangladesh; and the Damien Foundation, Belgium.

Leverage created by this project: National programme meetings held in Nepal and Bangladesh. The Damien Foundation continued VL testing in new foci in Bangladesh.

Gender aspects and vulnerable populations: 35/122 (28.6%) and 24/72(28.6%) government staff involved in the study were female in Bangladesh and Nepal, respectively. VL is a disease of vulnerable populations. Patients were diagnosed and treated for VL free of charge. Data gathered included on gender.

Training: 106 health workers in Bangladesh and 46 in Nepal were trained on VL and PKDL diagnosis.

Strengthened institutions and/or networks: Diagnosis and treatment of PKDL in leprosy hospitals in Bangladesh and Nepal continued. VL and PKDL case screening started in new foci in Nepal by government and in Bangladesh with the Damien Foundation.

Publications: One published, four under review and two in preparation (see Annex 1, ER 1.2.1).

Results dissemination and uptake : Dissemination resulted in initiation of elimination activities in new foci in both Bangladesh and Nepal, including focal spraying. Rapid tests distributed to health facilities. PKDL screening programme started in Bangladesh. There was also a stakeholders' meeting in East Africa.

ONCHOCERCIASIS ELIMINATION IN AFRICA

This project includes two complementary elements:

1. Research for tools for elimination programmes to support decisions to stop ivermectin mass drug administration, funded and managed by TDR to:

    a. Delineate parasite transmission zones (Note: The WHO *Guidelines for stopping mass drug administration (MDA) and verifying elimination of human onchocerciasis* is to be applied to transmission zones, but includes no criteria for delineating them. Objective criteria are currently not available (see Annex 1, ER 1.2.1).
    b. Estimate the risk of recurrence through human and vector migration should the criteria to stop MDA be met in only one part of the transmission zone and estimate risk of recurrence after MDA was stopped and after elimination of *O. volvulus* transmission was verified.
    c. Estimate the minimum number of reproductively active adult parasites. This tool would also allow to identify the origin of any resurgence after MDA was discontinued.

2. Research to support WHO and country decisions on inclusion of moxidectin in onchocerciasis elimination guidelines and policies, for which TDR provides scientific and technical support within a donor agreement between WHO and Medicines Development for Global Health (MDGH). MDGH is the not-for-profit Australian biopharmaceutical company to which WHO licensed all moxidectin-

related data at its disposal in support of MDGH becoming the regulatory sponsor of moxidectin and ensuring manufacturing of moxidectin for onchocerciasis control and elimination should moxidectin be included in WHO guidelines and country policies. In 2018, the US-FDA approved moxidectin for treatment of onchocerciasis in ≥12 year old individuals. The US-FDA is regarded by WHO as a Stringent Regulatory Authority which facilitates WHO prequalification and country regulatory approvals.

Progress in 2023

Research for tools for elimination programmes to support decisions to stop ivermectin mass drug administration, funded and managed by TDR

TDR funded research into the utility of genetic epidemiology for transmission zone delineation initially focused on the parasite genome. Given that, at any particular time, parasites may not be present in sufficient amounts to facilitate use of their genome to delineate transmission zones, this research was extended to evaluate the utility of the vector for transmission zone delineation based on preliminary work done by a Ghanaian student working in the laboratory of the Australian collaborators.

While mitochondrial DNA is easier to analyse, research to date suggests that nuclear DNA, but not mitochondrial DNA data, were consistent with epidemiologically relevant migration of blackflies between an area with continuing transmission and an area assessed as being close to achieving elimination of transmission.

Three high-quality nuclear genomes from *Simulium damnosum s.l.* from Ghana and Ethiopia, and *Simulium neavei* from Ethiopia have been assembled and can serve as the technical and analytical foundation for using vector nuclear genome markers to delineate transmission zones/identify the origin of blackflies.

The NTD programme in Ghana reported blackflies invading Greater Accra where they are not normally found. Identifying their geographic origin is a high priority for the programme. Consequently, blackfly collection from different ecological zones across Ghana is being expanded to the Greater Accra area and the flies caught there will be included in the genetic analyses planned within the project.

In 2023, progress has also been made towards providing the technical and analytical foundation for using vector nuclear genome markers to delineate transmission zones. Investigators at La Trobe have assembled three high quality nuclear genomes of vectors from Ghana and Ethiopia and developed an optimized protocol for sequencing with less DNA than standard protocol, thus reducing cost of procedure. Progress has also been made in the generation of predicted *O. volvulus* infection prevalence map of Ghana (which also trains a female Ghanian PhD student).

The “patch model” was developed to allow modelling of the risks of importing parasites from an area where MDA was stopped and into an area with ongoing low-level transmission (initially developed to model human migration). Progress has been made in expanding it to incorporate: i) vector migration; ii) human migration reflecting better the real nature of the “commuting” of humans between areas (not daily for a few hours, but for weeks or months for farming or other seasonal labour); and iii) the effect of MDA and heterogeneity of parasite response to the drugs administered. The latter will allow taking into account not only that currently available data suggest that susceptibility to ivermectin is not uniform (neither within, nor between endemic areas), but also that in future, different drugs may be used by onchocerciasis elimination programmes in different areas (e.g. moxidectin in some, ivermectin in others). In this context, collection of historical entomological data to inform the parameterization of the model was extended to include not only the countries of past and current TDR-funded investigators (Cameroon, Ghana), but also Ethiopia.

Bi-weekly meetings between Australian and Ghanaian researchers serve not only to build modelling capacity in Ghana, but also to discuss how to parameterize the patch model to achieve observed prevalence and how to improve the utility and ease of use of the model in view of the needs of the ultimate users, i.e. country elimination programmes. This includes development of visual display of the results. Work on testing impact of parameterizing vector movement from Metekel (uncontrolled endemic site) using genetic data on expected prevalence in Metema (a recently identified hotspot) has been completed. The implication of the findings is that blackfly migration from Metekel would be sufficient to re-initiate transmission after an MDA initiative was stopped and could be one reason for the observed transmission hotspot.

Integrated institutional and researcher capacity building and strengthening

Patch model development by the Australian collaborators at La Trobe University is accompanied by capacity building in the Ghanaian collaborators at the Noguchi Memorial Institute for Medical Research, University of Ghana, through bi-weekly virtual meetings between four Australian and three Ghanaian researchers. The latter includes Dr K. Frempong, who had previously benefited from modelling capacity building within a TDR pilot project for modelling fellowships, Ms Millicent Opoku and Mr J. Osei. Besides capacity building, these meetings also serve to inform the planned development of a user interface that will allow the model to be used by national NTDs programme staff.

Ms M. Opoku, a Noguchi Memorial Institute for Medical Research (NMIMR) PhD student in the laboratory of the Ghanaian collaborators, did a lot of the field work for this project as part of her PhD and is now enrolled as a PhD student at La Trobe University. She will continue work on her PhD in the laboratory of the Australian collaborators.

As part of the marker development, larval samples collected from some of the sites have been identified by cytotaxonomy in Ghana by Mr Sedou Naniogue, an END FUND consultant from Togo, with leveraged funding from END FUND. This has included identification and cytotaxonomy training of Ghanaian staff at NMIMR since July 2023 and training is expected to end by November 2023. Currently five members of the onchocerciasis team in Ghana are being trained for the cytotaxonomy. Following cytotaxonomic identification, samples are sent to Australia for sequencing.

Research to support WHO and country decisions on inclusion of moxidectin in onchocerciasis elimination guidelines and policies

Following completion of the paediatric dose finding and safety study in Ghana in 2022, the population-pharmacokinetic model was updated with the data from that study and a moxidectin dose identified for children aged four to seven years (4 mg) and children aged eight to 11 years (8 mg, the same dose approved for persons ≥12 years).

This allowed amendment of the protocol for the ongoing single dose safety study[14] to allow inclusion of up to 200 children aged four to 11 years. Recruitment of 187 children at the study site in the Democratic Republic of the Congo (Centre de Recherche pour les Maladies Tropicales Negligées Rethy, Ituri, Democratic Republic of the Congo (created by TDR for the moxidectin Phase 3 study) progressed much faster than anticipated. This is attributed both to the study team in the Democratic Republic of the Congo and to the fact that children are only recruited in villages where adults and adolescents have or are participating in one of the two moxidectin studies ongoing in the Democratic Republic of the Congo, ensuring that parents have first or second hand experience with moxidectin clinical trials. This provides them with a better basis for deciding on participation of their young child than any information document/discussion can provide. In consideration of the fact that WHO and countries will appreciate more safety data in for children aged four to 11 years when considering inclusion of

[14] See MDGH-MOX-3002, https://clinicaltrials.gov/study/NCT04311671.

moxidectin in guidelines and policies for onchocerciasis elimination, and following review of the safety data from the 187 children by physicians on the Data Safety and Monitoring Board (DSMB) and their endorsement of the plan to increase the number of children to be recruited, a protocol amendment was submitted in October 2023 to increase the maximum number of children to be enrolled to approximately 1,250. Given the time to approval of this amendment by the WHO ERC and budget restrictions for study conduct in the Democratic Republic of the Congo, recruitment of additional children is unfortunately not possible.

Recruitment capacity for study MDGH-MOX-3002 has been increased by addition of a second site, located in Côte d'Ivoire. That site initiated recruitment of ≥12 year old individuals in Q2 2023. Preparation for submission to obtain approval for recruitment of children is ongoing.

The protocol for the double-blind study comparing the parasitological efficacy and safety of moxidectin or ivermectin upon three annual and five biannual treatments (MDGH-MOX-3001, conducted in the Democratic Republic of the Congo [15]was amended to reduce the number of participants from 1000 to 320, the sample size that provides ≥95% power at a two-tailed alpha level of 0.05 for the primary efficacy hypothesis. This was driven by the fact that recruitment into this study was much slower than expected, attributed to the fact that the percentage of individuals meeting the intensity of infection inclusion criterion was much lower than anticipated based on the data obtained during the Phase 3 study in 2009–2011.

The tablet formulation currently approved by the US–FDA for use in ≥12 year old individuals (and used to treat children in the ongoing studies) was developed with a lower age limit of four years in mind, but smaller children aged four to five years may prefer a paediatric formulation. Furthermore, moxidectin is also being developed for scabies (without TDR input) which requires treatment of very small children. With co-funding from MDGH, EDCTP and Luxemburg,[16] work towards a paediatric formulation has been initiated. Completion is pending further fund raising. Within the WHO initiative for paediatric drug optimization for NTDs,[17] moxidectin was included (together with ivermectin) on the Priority List for development of a paediatric formulation for scabies and onchocerciasis.

Plans for 2024–2025

Research for tools for elimination programmes to support decisions to stop ivermectin mass drug administration, funded and managed by TDR.

Currently ongoing projects are not expected to be funded by TDR beyond 2024. While the objective of adoption of the resulting tools is unlikely to have been achieved by then (so far only one country has adopted inclusion of genetic data into its definition of transmission zones), the results obtained are expected to allow investigators to raise funding from other source since dissemination efforts in past years have confirmed the interest of the "wider oncho community" in the targeted tools. In this context, the principal investigator at La Trobe University and the TDR Project manager have shifted focus from exclusively on progressing the research itself to publishing the results of the research. This is expected to continue through 2024.

[15] See (https://clinicaltrials.gov/ct2/show/NCT03876262; https://mox4oncho-multimox.net/resources).

[16] More information is available on the EDCTP website at: https://www.edctp.org/projects-2/edctp2-projects/paediatric-drug-formulations-poverty-related-diseases-2019/.

[17] WHO. *Paediatric drug optimization standard procedure*, 2022. Available at: https://www.who.int/publications/i/item/9789240039520.

Research to support WHO and country decisions on inclusion of moxidectin in onchocerciasis elimination guidelines and policies

Dr Annette C. KUESEL who has been leading moxidectin development for the past >20 years and retired in 2023, will continue to provide nil-remunerated consultancy support to TDR work on Onchocerciasis, and in particular to the work on moxidectin until WHO and countries have made a decision on inclusion of moxidectin in onchocerciasis elimination strategies.

TDR will be engaging with countries and MDGH to provide its expertise in implementation research, directly or within the ADP programme. Currently, TDR is planning to conduct a study in Ghana for measuring the acceptability, feasibility and community preferences for moxidectin treatment. The results will fill in gaps in the data needed to inform WHO decisions on including moxidectin in onchocerciasis elimination guidelines since (with the exception of the paediatric dose finding study) all studies conducted so far were double-blinded trials.

Contributions towards TDR key performance indicators

Partnerships and collaborations: Noguchi Memorial Institute for Medical Research (NMIMR), Ghana; University of Health and Allied Sciences, Ghana; Onchocerciasis Elimination Programme Laboratory Ethiopia; La Trobe University, Australia; University of Antwerp, Belgium; Division Provinciale de la Santé, the Democratic Republic of the Congo; Medicines Development for Global Health, UK and Australia; Eglise du Christ au Congo, Democratic Republic of the Congo; European and Developing Countries Clinical Trials Partnership (EDCTP); Erasmus University, Netherlands; Imperial College, UK; Luxembourg Institute of Health; Royal Veterinary College, UK; Centre for Research on Filariasis and other Tropical Diseases, Cameroon; and the Institut de Recherche pour le Développement, France.

Leverage created by this project: For research into genetic markers for *O. volvulus* suboptimal response to ivermectin and transmission zones: NIH: US$ 3 488 641, Nov 2019-Nov 2024, The END Fund: US$ 573 864, Oct 2022-Apr 2024.

Gender aspects and vulnerable populations: PIs: One man from Ghana, One woman from Australia. Onchocerciasis (and lymphatic filariasis) affect rural marginalized populations. Individuals participating in the efficacy and safety studies of moxidectin will benefit from administration of moxidectin or ivermectin. In the absence of relevant data, pregnant and breast-feeding women are excluded from these studies. The studies include collection of data on the pregnancies of women that became pregnant after taking moxidectin or ivermectin, pregnancy outcome and the health of the newborn up to one year of age. This will complement the same type data collected during the TDR-funded and managed Phase 2 and 3 studies of moxidectin which were the pivotal data supporting the 2018 moxidectin US-FDA approval. Ultimately these and data that will emerge from pilot implementation studies, and if applicable, use of moxidectin for MDA, will allow to provide data on which to determine guidance for inclusion/exclusion of pregnant women from MDA.

Training: Number of advanced degrees underway: One male PhD student from Cameroon in Ghana, one female PhD student from Ghana in Ghana and Australia.

Strengthened institutions and/or networks: None

Publications: Seven published, three under review. (See Annex 1)

Results dissemination and uptake: None directed by TDR

ER 1.2.6: Optimized approaches for effective delivery and impact assessment of public health interventions

Operational/Implementation research (OR/IR) embedded within national disease control programme activities aims to improve the effective delivery of health interventions. IR is a key driver for: i) assessing the quality and effectiveness of a disease control programme intervention; ii) understanding the barriers for a fully effective intervention; iii) developing new strategies to improve effectiveness and cost-effectiveness; and iv) piloting and implementing successful strategies at scale.

TDR activities are conducted at national, regional and global levels and are driven by the demands and strategies of WHO disease control programmes, such as those for TB, neglected tropical diseases, malaria and pharmacovigilance and/or WHO regional offices, as well as national disease control programme priorities. Activities under this ER combine financial and technical support for conducting IR, translating research into national policy and/or practices, and strengthening capacity for conducting IR among disease control programme staff to improve the delivery of public health interventions.

The activities conducted under this ER can be categorized as related to **tuberculosis, malaria**, **NTDs**; drugs/vaccines **safety** monitoring, and **pharmacovigilance** activities and **digital health** activities

Progress in 2023

Tuberculosis-related activities

- *Launch of the new regional network of National TB Programmes in Southern and Eastern Africa (SEARN-TB)*: This network, modelled on the WARN/CARN TB network,[18] seeks to promote greater coordination and communication between NTPs in the Southern and East Africa and provide a platform for building IR capacity. The establishment was supported by the German Federal Ministry of Health under the new project with the Robert Koch Institute. Twenty-four NTPs across the region and partners from AFRO, EMRO and WHO–GTB participated in a preliminary webinar to propose the concept of the network in April and was followed by an in-person meeting to officially launch the network in May 2023, which was attended by NTP coordinators from 16 countries in Southern and East Africa, as well as WHO Regional Offices and other partners. During the meeting, held in Addis Ababa, the Terms of Reference for the SEARN-TB network were established and the Armaeur Hansen Research Institute were confirmed as the network secretariat and Malawi and Ethiopian NTPs were nominated to co-chair for a preliminary one-year term. In October 2023, a second in-person workshop was held in Addis Ababa among 22 M&E focal points from the region on TB surveillance and IR capacity strengthening, in collaboration with the Robert Koch Institute and WHO–GTB and funded by the German Federal Ministry of Health.

- In 2023, the WARN/CARN Regional Network for TB Control Secretariat gained greater autonomy with less direct technical and financial support provided by TDR, now co-funded by the International Union Against Tuberculosis and Lung Disease (The Union). A series of webinars have been held on: i) new WHO recommendation for DR-TB treatment; ii) WHO recommendations for childhood TB treatment decision algorithms; and iii) a webinar to share experience on NTP negotiations of the GC7 with the Global Fund. The 2023 WARN-TB/CARN-TB annual meeting will be jointly funded by the Global fund (50%), WHO–GTB (20%) and TDR (30%). Based on the 2022 discussions with the NTP coordinators, a working group work for measuring the impact of

[18] See https://tdr.who.int/activities/african-regional-research-networks-for-tb-control.

insecurity (political and from other causes) on NTP functioning was established. The survey is ongoing, and results will be presented/discussed at the next WARN-TB/CARN-TB meeting.

- TDR's involvement in strengthening social protection for people living with and affected by TB continued in 2023 through three key activities:
  - Continued ***Financial and technical*** support to six countries identified under the funding scheme launched in late 2022 to support IR projects in the WHO African Region and build the evidence base on the impact of social protection schemes for TB patients and their families, conducted in collaboration with WHO–GTB, The Union, Paris; and the Damien Foundation, Belgium. Twelve applications were received and eight were selected for small grants funding of around US$ 20 000 to US$ 25 000 (two of which are being funded by The Union and the Damien Foundation, respectively). Project implementation began at the end of 2022 with final results expected by the end of 2023;
  - ***Development of a generic IR toolkit for evaluating the impact of social protection schemes for TB patients and their families,*** which was completed in September 2023 and will be shared with key partners and stakeholders for technical review and validation at the end of 2023 and;
  - Supporting WHO–GTB to conduct a landscape analysis of social protection schemes in the Democratic Republic of the Congo, to gather evidence on key gaps and recommendations for strengthening the overall SP landscape in these contexts.
- The ShORRT project[19] continues, with 27 countries currently launching or conducting their OR project . Financial and technical support to study teams in Nigeria and the Democratic Republic of Congo continued in 2023 as part of USAID support. As part of TDR's support to countries, a generic statistical analysis plan was developed to inform a standardised approach to analysis of key treatment effectiveness, safety, and quality of life outcomes at end of treatment and follow up time points. Additional technical support by external consultants and the Luxembourg Institute of Health was provided to countries to support analysis.

- The Diagnosis of Multidrug-resistant tuberculosis in Africa (DIAMA) project funded by EDCTP and led by the Benin NTP, in collaboration with TDR and partners aimed at evaluating new molecular tests for drug-resistant TB (DR-TB) diagnosis and find new methods to replace processes for follow-up of DR-TB patients during treatment. Study results were shared with the WHO Global TB department to update WHO–GTB guidelines in particular for the endorsement of Xpert 2nd line drugs, Truenat and Genoscreen platform. Study results were disseminated through oral communications and scientific papers are under development.
- An evaluation of the level of **Implementation of the roadmap for Zoonotic TB promoting a One Health approach in Africa and South/West Pacific regions** was conducted in collaboration with the WHO–GTB department of the WHO, the FAO, WHO and the regional offices of the African, South East Asia and West Pacific regions: 1) assess the implementation of the "Roadmap for Zoonotic TB" in countries in Africa and Asia; 2) compile best-practice case studies on the successful operationalization of One Health, with particular focus on zoonotic TB; and 3) define a five-year action plan to strengthen the operationalization of the roadmap for the African region. Survey results will be shared at The Union World TB Conference (November 2023). A scientific paper is under development.
- The TDA4Child initiative[20] kicked off in May 2023. Following the 2022 WHO interim conditional recommendation relating to the general use of integrated treatment decision algorithms (TDAs) for tuberculosis (TB) treatment decision-making in children,[21] the TDA4Child initiative proposed

[19] The ShORRT initiative and information on its projects is available at: https://tdr.who.int/activities/shorrt-research-package.

[20] The TDA4Child initiative and information on its projects is available at: TDA4Child initiative.

[21] See WHO consolidated guidelines on the management of TB in children and adolescents, 2022.

tools aiming to facilitate the conduct of operational research, and to generate data that are harmonized across different implementation settings using a standardized methodology. Tools include: protocols, paper and electronic collecting tools, SOPs, a manual of operations and training material in French and English. Treatment decision algorithms are designed to help clinicians make a decision to start TB treatment in a child, based on microbiological, clinical and radiological evidence. Two evidence-based TDAs are included in the accompanying operational handbook on the management of TB in children and adolescents[22], aiming at improving case detection. TDR provides technical support to the adaptation of the master protocol in Democratic Republic of Congo, Nigeria and Burkina Faso where the study will be rolled-out by the end of the year. A consortium with Benin, Senegal, Togo and Guinea is working on a regional protocol with the technical support of TDR and The Union. The goal is to gather data for the revision of the WHO recommendation by mid-next year.

Malaria-related activities

- Of the 13 SMC implementing countries, three national malaria programmes (NMPs) have completed their studies: Guinea, Ghana and Nigeria presented their work at the 2023 ASTMH (American Society of Tropical Medicine and Hygiene) conference. Nigeria published their study results.[23] The NTPs of Guinea and Ghana drafted study manuscripts that should be submitted by the end of the year. Seven countries (Niger, Mali, Senegal, Burkina Faso, Cameroon, Benin, and Togo) have finalised their study and are analysing their results. The NTPs of Cameroon, Mali and Burkina Faso will present their results at the EDCTP forum (November 2023 in Paris) during an SMC symposium. The three remaining countries (Chad, The Gambia, and Guinea Bissau) are in the process of finalising their projects proposals.
- TDR led the organization of a one-week training on Implementation research with specific sessions on qualitative research. This was an online training aiming mainly at strengthening the capacities of the NMPs in the analysis of their study results and particularly their qualitative research data.
  In addition, TDR co-organised with WHO–GMP a meeting with representatives of all national malaria programmes implementing SMC and international experts in the field to update the Seasonal Malaria Chemoprevention Field Guide.[24]
- Supporting South-South knowledge exchange to support the roll out of the Malaria RTS,S vaccine.[25] In January 2023, a face-to-face workshop co-hosted by the OPT-SMC initiative and TDR through the Access and Delivery Partnership (ADP) was organized in Dakar with technical input from GAVI, WHO Malaria Vaccine Implementation programme, the WHO Regional Office for Africa, PATH and other stakeholders. Representatives from NMPs and Expanded Programmes of Immunization (EPI) from the 13 OPT-SMC African countries were invited discussed implementation strategies and mode of delivery in countries with seasonal malaria high transmission and low or moderate EPI coverage during the first and second year of life. The study report is published. The operational/implementation research needs to document the implementation of RTS,S and other malaria vaccine in this epidemiological context in terms of uptake and effectiveness, safety and acceptability was also discussed, and a list of questions raised by the NMPs and EPI programmes documented.

[22] See https://www.who.int/publications/i/item/9789240046832
[23] See publications list #63
[24] WHO. Seasonal malaria chemoprevention with sulfadoxine–pyrimethamine plus amodiaquine in children: A field guide. 2023. Available at: https://tdr.who.int/publications/i/item/9789240073692.
[25] See https://tdr.who.int/activities/paving-the-way-for-rts-s-as01-vaccine-implementation-through-research.

NTD-related activities

- ***SKIN NTD:*** Support was provided to the National Buruli Ulcer and Yaws Eradication Program of the Ghana Health Service to evaluate gender-related factors affecting access to health services and care of skin-related neglected tropical diseases (skin NTDs) in three districts in Ghana, both from the perspective of patients and of healthcare workers. The study highlighted that while women had better knowledge of the causes and symptoms of skin NTDs than men and would seek treatment at hospitals preferentially over herbalists (the opposite to the treatment-seeking behaviour of men), women's treatment-seeking behaviour was strongly influenced by men due to unequal power relations, gender roles and access to resources. This will inform Ghana's plan to integrate NTDs care into basic health services, taking into account gender-based specificities. A feasibility study to test the WHO skin-related NTDs through a mobile app[26] is at a final stage of completion.

- ***Schistosomiasis:*** TDR is supporting the MOH in the United Republic of Tanzania for the introduction of arpraziquantel, the paediatric formulation of Praziquantel. This activity is in anticipation of marketing approval. This is done as part of the ADP project with contribution of other ADP partners such as PATH for the forecasting and procurement aspects and WHO regulatory department for the regulatory approval process. TDR is mainly providing technical and financial assistance to the National Institute for Medical Research for preparatory work with raising awareness and identifying potential introduction barriers within the community, definition of the best model of delivery to consider (national dialogue meeting and key stakeholder engagements) and the development of an implementation research protocol for evaluating the three delivery models that were proposed during the national dialogue and strategies for involving the community in the delivery. Further support is provided to including a costing element in the research project.

- ***Onchocerciasis:*** TDR is collaborating with Medicines Development for Global Health (MDGH) for the conduct of an implementation study in Ghana for measuring the acceptability, feasibility and community preferences. This is needed for finalising the moxidectin portfolio for WHO–NTD review for guidelines (planned in 2024)

Drug and vaccine safety and pharmacovigilance (PV) activities

- In 2023, TDR continued to support the use of digital health technologies for safety and pharmacovigilance – specifically the MedSafety app, USSD coding system in Burkina Faso and Malawi, respectively (these activities are further described under section 5: digital health –related activities). In addition to supporting the evaluation of the USSD system in Malawi, TDR has also continued to support the Pharmacy and Medicines Regulatory Authority of Ghana in completing the evaluation of the impact of training on PV among healthcare workers. The Ghana team submitted a manuscript that was accepted for publication and the Malawi team is drafting a paper to share their results. It should be submitted for publication by the end of 2023.
- Activities concerning anti-TB drug-safety monitoring and management (aDSM) and implementation in 2023 included: i) updated aDSM resources for in-country training in both French and English languages, in line with WHO guidelines; ii) South-South visits to strengthen the regional technical capacity between NTPs in Senegal (three selected staff), the Democratic Republic of the Congo, and Burkina Faso to support the development and testing of national aDSM

[26] WHO. Advancing the management of skin-related neglected tropical diseases in Ghana: Exploration of gender-related factors and mobile technology. News Release, 14 December 2022. Available at: https://tdr.who.int/newsroom/news/item/14-12-2022-advancing-the-management-of-skin-related-neglected-tropical-diseases-in-ghana-exploration-of-gender-related-factors-and-mobile-technology.

guides; and iii) development of a training material on aDSM that can be used by countries, which should be made available on the TDR website by the end of 2023.

Digital health

TDR's work done in digital health technology is available on the TDR website.

- The Implementation Research for Digital Technologies and TB (IR4DTB) toolkit was used as the central teaching tool for a week-long workshop for NTPs of the WHO African Region targeting NTP staff in May 2023. Following the workshop, 16 proposals were received, 11 of whom are being supported with financial and technical support to conduct IR to test, evaluate and/or scale up new digital technologies within the context of a country's national response to TB. Ongoing support was also provided to the six country teams funded after the 2022 IR4DTB workshop in the WHO EURO region, most of whom are evaluating the use of computer-aided detection (CAD) software for TB screening, including conducting calibration studies using the CAD for TB detection calibration toolkit.[27] Final results and study manuscripts will be completed by the end of 2023. Through support from the Mayo Clinic, the IR4DTB site has been translated into Spanish to extend its reach into Latin and South America. In 2024, new opportunities will be explored to deliver the IR4DTB workshop in Spanish in collaboration with PAHO.
- IR on digital tools in Burkina Faso: TDR continued to support Burkina Faso's National TB Program (NTP) in 2023 to introduce and evaluate 99DOTS, a digital tool used to alleviate the requirement of frequent trips to and from the health facility as part of the requirements of Directly Observed Treatment required for TB patients, by monitoring treatment adherence at a distance. In 2022, TDR supported the NTP to pilot and an evaluation was commenced to assess the acceptability and utility of 99 DOTS. In 2023, data of 200 users has been collected and the study results will be presented as an oral presentation at The Union World Conference on Lung Health, in Paris in November 2023. This is funded by ADP and the Global Fund.
- The national PV authorities of Burkina Faso and Ghana received support to assess the use of the MedSafety App for adverse drug reaction reporting. Their findings are being disseminated (presentation at the 2023 African Conference on Pharmacovigilance for Senegal and a manuscript submission for Ghana).

Contributions towards TDR key performance indicators

Partnerships and collaborations: WHO–GTB; WHO–GMP; WHO Malaria Vaccine Implementation programme; AFRO; EURO; SEARO; WPRO; WARN/CARN Regional Network for TB Control; UNDP; FAO; Action Contre la Faim, France; EDCTP; GFATM; Institute of Tropical Medicine, Belgium; University of Thiés, Senegal; the Access and Delivery Partnership; The Union, Paris; the Damien Foundation, Belgium; University of Oslo; Robert Koch Institute, Berlin; Médecins sans Frontières, Paris; Stop TB Partnership, Switzerland; McGill University, Canada; London School of Hygiene and Tropical Medicine; US Agency for International Development; University of California, San Francisco; Luxembourg Institute of Health; Medicines for Malaria Venture (MMV), Switzerland; GAVI; and the World Organisation for Animal Health (WOAH).

Leverage created by this project: around US$ 1 million leveraged from the Global Fund for the conduct of the ShORRT operational research projects.

[27] For the CAD for TB Toolkit and additional information, see https://tdr.who.int/activities/calibrating-computer-aided-detection-for-tb.

Gender aspects and vulnerable populations: Gender equity is one of the guiding principles of this ER. In addition, the activities of this ER are particularly targeting vulnerable populations such as children under five years old (malaria-related projects), pregnant women (pregnancy exposure registry), nomadic populations, prisoners and severely poor people (TB-related projects). All research conducted in this ER aim at facilitating access to care for this under-served population.

Training:

- One-week online training: Good data management practices and use of REDCap for data management for countries involved in the ShORRT initiative – 70 participants (national TB programme staff of 15 countries) training in English, French and Spanish.
- One week training: IR4DTB WHO AFRO (May 2023) – 30 participants (National TB programme Staff of seven countries).
- One-week online training: Implementation research and mixed methods 30 participants (National Malaria Programmes of 13 countries), in French and English.
- TB surveillance training for the SEARN-TB countries: Addis Ababa, Ethiopia (October 2023) – 22 M&E staff from Southern and East African NTPs.

Strengthened institutions and/or networks: Operational/implementation research capacities of the Institutions within the MoHs in target countries were strengthened through learning by doing research activities with TDR support and mentoring. Creation of the new regional network of NTPs in Southern and Eastern Africa (SEARN-TB).

Publications: 11

Results dissemination and uptake: Several publications, national dialogues, regional webinars and workshops.

Concerning research results uptake, this model with country-led research project is efficient for changing practices. Based on the results of the external evaluation of the WARN-TB/CARN-TB activities, around 70% of the implementation/operational country-led research projects that were conducted guided national TB control policy/practices for improving TB control. The results of the DIAMA project informed the updated of the WHO guidelines for the endorsement of the Xpert 2nd line and of Genoscreen platform.

Plans for 2024–2025

TB-related activities

- The new toolkit to evaluate the impact of social protection schemes on TB patients and their families will be pilot tested in one to two country programme contexts, followed by the launching of the finalized toolkit.
- Supporting will be given to countries to publish the results of their IR on social protection studies, IR4DTB projects or other IR projects mentioned in this report.
- Under a renewal of USAID funding, continued support will be provided to Nigeria and the Democratic Republic of the Congo to disseminate the final results of the ShORRT study. This will be undertaken through preparation of scientific manuscripts and national feedback meetings with NTPs and key stakeholders in both countries to influence national TB strategy. In addition, Mozambique will be given support for the completion of data collection, data analysis and written communication. Provision of technical support will continue to other countries involved in ShORRT in the data analysis phase and in the preparation of study manuscripts.

- Support to SEARN-TB will strengthen work with NTPs in the region, and further strengthen TB surveillance systems. This will include defining TB control gaps and research priorities, including holding an annual meeting (2024) and delivery of IR training and other capacity-building activities to members.
- TDR will address one of the activities related to IR/OR in the strategic action plan of the WARN-TB/CARN-TB (the theme of insecurity and continuity of TB care as an area of interest).
- A TDR resource hub will expand distribution and access to generic research tools and protocols (data sharing agreements, online space on TDR website, etc.).

Malaria-related activities

- The OPT-SMC project will be finalized with support to the NMPs for oral or written communications and use of the study results to improve OPT-SMC delivery.
- Organization of a national dialogue on the introduction of a malaria vaccine will take place in Senegal.
- Funding application to EDCTP3 on optimizing the delivery and uptake of malaria vaccines in countries with areas of highly seasonal transmission in West and Central Africa – OPT-MVAC (Optimizing the effectiveness of Malaria VACcine)

NTDs

- The evaluation of the WHO–NTD skin app will be finalized with the aim to eventually support its use in other countries (the Damien Foundation for leprosy in the Comoros or Latin America).
- Support will be given to the WHO–NTD department in the United Republic of Tanzania for the mass drug administration of praziquantel for children under 5 (provided that the drugs are available).

Safety

- Finalization and valorisation will take place of all the IR projects conducted on the use of innovative tools to monitor safety (global paper on the lessons learned).
- Safety monitoring will be embedded in the IR projects for e-praziquantel, a malaria vaccine and moxidectin, building on lessons learned from SMC which is also an MDA.
- The handover of the Pharmacovigilance (PV) Database to the WHO–PV department is planned.

Digital health

- Continued support will be given to IR4DTB participants from the African region IR4DTB Workshop for the conduct and completion of their IR projects.
- A lessons learned document will be developed for the use of CAD by NTPs.
- Enhanced collaboration and new partnerships will be established with WHO's Digital Health and Innovation Department to further develop the current portfolio of digital health activities.
- To further develop the TDR portfolio on IR and digital technologies, one to two demonstration projects will be identified and supported, particularly as they relate to the four major global health challenges targeted in the new TDR strategy.

ER 1.3.12: Strategies to promote gender-responsive health interventions on prevention and control of infectious diseases of poverty

TDR's strategy on gender research focuses on strengthening research capacities on intersectional gender analysis, particularly in research on infectious diseases, generating evidence on gender intersecting inequalities in access to health services, supporting intersectional gender analysis in research for implementation, and promoting an inclusive infectious disease research agenda. An increased number of research teams in LMICs have started incorporating an intersectional gender lens in their research plans and research capacities have also been strengthened to incorporate sex and gender dimensions in health research.

The above-mentioned strategy guides TDR's projects to address gender inequalities and health inequities in a more systematic way, recognizing the importance of understanding how gender power relations intersect with other social variables to create differences in health needs, well-being, and experiences. It calls to strengthen research and research capacity strengthening efforts across different TDR initiatives to effectively incorporate gender dimensions that intersect with other axes of inequality (e.g., age, disability) to leave no one behind.

This ER describes the progress of three types of projects: projects completed in Nepal and Uganda to pilot the TDR intersectional gender analysis toolkit, projects under way in Ethiopia and Bangladesh and projects in Bhutan and an African consortium from Kenya, Malawi and South Africa on infectious diseases and gender and intersectionality.

In addition, the TDR MOOC on Incorporating an Intersectional Gender Perspective in Implementation Research is also being offered in 2023 in collaboration with the African RTC based in Ghana, after its pilot and launch in 2022.

Progress in 2023

1. Two research teams from Nepal and Uganda piloted the TDR Toolkit to incorporate intersectional gender analysis in infectious diseases of poverty. In 2023, Nepal published one article in the Journal of Infectious Diseases of Poverty focusing on lymphatic filariasis research, and an article on schistosomiasis from Uganda has been published in PLOS Neglected Tropical Diseases at the end of 2023.

2. Following a call for proposals for "Implementation research and gender, teams in Bangladesh and Ethiopia" received WHO ethics approval in 2023. In Bangladesh, the study entitled "Facilitators and barriers of management of multidrug-resistant tuberculosis in Bangladesh: An Implementation Research through a Gender Lens" is being conducted by BRAC James P. Grant School of Public Health, BRAC University. The objective is to generate evidence to identify the enablers and bottlenecks that impact the delivery of current management of MDR-TB in Bangladesh and see how gender intersects with other social variables influenced by specific contextual and structural determinants potentially leading to different gendered experiences and thus gender inequality.

    - This mixed method study consists of quantitative component comprising record review (hospital and TB registry), household survey and phone survey will be embedded within the qualitative component consisting of document review, in-depth interviews (IDIs), key informant interviews (KIIs), focus group discussion (FGD) and observation. It will be conducted at five tertiary specialized TB hospitals across the country which offer MDR-TB treatment.

- The analysis will be done to identify the sex specific factors associated with MDR treatment enrolment, compliance, and completion. The qualitative data will explore gender related domains including access to resources, division of labour, roles, and everyday practices, social norms and values, and decision making. After receiving the ethics approval from ERC WHO and local institution review board in July 2023, the research team recruited field researchers, trained them and deployed them to the different study sites for data collection.

- In Ethiopia, the study entitled "Uncovering intersectional gender inequalities influencing vulnerabilities, access to and uptake of malaria services, and developing a participatory gender-responsive framework toward malaria elimination in Ethiopia" is being conducted by Jimma University.

- The objective of this IR study is to:
  - To explore intersecting gender inequalities in malaria vulnerability, and burden (morbidities and mortalities) and its underlying structural, contextual, socio-cultural, psychological and programmatic barriers, challenges, and facilitators/enablers in Ethiopia.
  - To quantify intersecting gender inequalities in malaria vulnerabilities, burden, access-use to preventive and treatment services, and statistically model the structural and socio-cultural, psychological, and programmatic underlying factors of gender-inequalities in Ethiopia.
  - To co-develop and validate feasible, effective, and acceptable community-engaged participatory gender-responsive framework of malaria prevention, treatment, and elimination practices in Ethiopia.

- This mixed-method sequential study involving qualitative and quantitative methods is being conducted in six sites from two malaria-endemic districts of Jimma zone, Oromia regional state, Ethiopia. Multiple methods, namely desk reviews, review of malaria surveillance data, household surveys (with 2244 respondents), explorative qualitative study by conducting 12 FGDs and 12 KIIs, will be followed by four nominal group discussions. After receiving the ethics approval from ERC WHO and local institution review board in May 2023, the research team have recruited field researchers, trained them, and deployed them to the different study sites for data collection. Till date, they have completed the desk review to identify available evidence regarding intersecting gender inequalities in malaria vulnerability, burden, access and utilization of malaria prevention and control services. They have completed analysis of five-year (2018–2023) malaria surveillance data of 8 healthcare facilities serving six Gandas (two urban and four rural) from two endemic districts (Shabe Sombo and Dedo) of Jimma zone. They have also established community advisory group consisting of nine members from two study districts. The diverse group of members were recruited through engaging zonal and district malaria managers and community health workers in their respective villages.`

3. In response to TDR's Call for proposals "Generating evidence to strengthen intersectionality and gender research efforts in infectious disease prevention and control", a research team from Bhutan and a multi-country consortium with research teams from Kenya, Malawi and South Africa were selected at the end of 2021**.** Both research teams have completed data collection and are currently finalizing their data analysis. The results presented here are preliminary findings.

   - The team in Bhutan has implemented a study entitled "Exploring the intersections of sex and gender dimensions with other social stratifies in accessing tuberculosis (TB) and dengue healthcare services of transgender men (TGM), transgender women (TGW), men who have sex with men (MSM), women who have sex with women (WSW) in Bhutan". The main research

objective was to generate evidence on how gender identity, sexual orientation, and other social stratifiers (such as age, sex, ethnicity, education, wealth) intersect to influence access to TB and dengue care and services in Bhutan to inform gender-responsive and human rights-based health policy and healthcare service delivery.

- This mixed method study was conducted in four major towns of Bhutan, namely Thimphu, Mongar, Gelephu, and Phuentsholing. The study participants were TGM, TGW, MSM, and WSW who were ≥18 years of age residing in the selected study sites.

- **Preliminary results under analysis:** The initial results represent experiences of key population, i.e. MSM, WSW, TGM and TGW across the social stratifiers (age, sex, income, ethnicity, marital status, education and occupation) intersecting with gender domains, and eventually shaping the healthcare access domain (structural, cognitive, psychological and financial) of an individual. Among 282 study participants, 60.6.5 were males and 39.4% were females. In terms of gender identity, they identified 48.6% as men, 24% as TGM, 17% women and 11% TGW. Out of the 282 study participants, 12 (4.3%) of them have suffered from TB while nine (3.2%) of the participants have suffered from dengue. Only one (0.4%) suffered from both dengue and TB. An equal number of male and female participants suffered from TB and dengue.
  - Analysis of data focuses on healthcare seeking behaviour, structural barriers accessing healthcare services, financial, cognitive, and psychological barriers.
  - Although interviews captured the experiences of more than 282 individuals from the LGBT+ community, only 12 of them suffered from TB, nine suffered from dengue and one was affected by both TB and dengue. Thus, the findings include experiences in seeking general healthcare services and not limited to TB and dengue.
  - Although there is no specific legislation prohibiting healthcare discrimination based on sexual orientation and gender identity in Bhutan, the LGBT+ population in Bhutan face various barriers in accessing health services, including TB and dengue care services, which is influenced by gender and its intersection with other social stratifiers. Fear and the actual experience of stigma and discrimination discourage key population from seeking needed healthcare services and this result in missed opportunities for prevention and treatment of diseases that are both preventable and curable.
- **Key recommendations are:**
  - Advocacy, awareness and sensitization of community using social media, monastic and religious bodies to increase acceptance of LGBT+ population in Bhutan.
  - Development of a policy on gender sensitive health services and develop strategies to build trust in the health system and non-discriminatory service delivery.
  - Strengthening routine data collection and surveillance to be more inclusive.
  - Develop and include a curriculum to enhance the capacity of health workers to respond appropriately to the health needs of LGBT people, and design training packages for the health workers to provide gender sensitive healthcare services.

4. A multi-country consortium with teams from Kenya, Malawi and South Africa are working in collaboration in a study entitled **"An assessment of gender and intersectionality in disease exposure, care seeking behaviour and treatment pathways in Malaria and Tuberculosis prevention and control in Kenya, Malawi and South Africa".** The study in Migori County, Kenya and Chikwawa district in southern Malawi is focusing on gender and intersectionality in disease exposure, care seeking behaviour and treatment pathways in malaria prevention and control. The study in Eastern Cape Province, South Africa is conducting gender and intersectionality analysis of Tuberculosis pre-treatment loss to follow up. Currently, all three countries have finished data collection and are completing the data analysis.

- **Study applying an intersectional gender lens in disease exposure, care seeking behaviour and treatment pathways in malaria prevention and control in Kenya and Malawi**

  Both studies adopted a longitudinal study design with embedded mixed methods to allow for translational research and long-term in-depth exploration. The research employed participatory, qualitative and quantitative methods to explore gender and intersectionality of malaria aetiology, health seeking and treatment pathways. The study also examined gender differentiated roles, access to information and utilization malaria healthcare services and applied an intersectional lens in Malaria programme delivery in the emerging COVID-19 pandemic context. Participatory qualitative and quantitative methods with community members and stakeholders at county and community levels including the healthcare providers, policy influencers and implementing partners were used to assess and describe the intersection between the risk of Malaria disease exposure with gender, and other social determinants of malaria. The study used a five-pronged approach which included literature review, household/individual interviews, key informant interviews, focus group discussion interviews and in-depth interviews were used.

  For the qualitative research, purposive sampling was employed targeting potential participants using maximum variation approach. In Kenya six KIIs and 26 IDIs whereas in Malawi 15 KIIs and 15 IDIs were conducted with community leaders, community health volunteers (CHVs), healthcare providers and other stakeholders in malaria prevention control from community, county to national level. In Kenya, they conducted four FGD, two separately for males and females representing rural and urban areas. Malawi team conducted five FGDs (two with females, two with males and one with both male and female participants sex) embedded with participatory rural appraisal comprised between six and 12 purposively identified participants (n=60) in the community. The qualitative data analysis was iterative to inform the study. A code book was developed with intercoder agreement among the qualitative research team, data coded on NVivo, and thematic and content analysis informed by grounded theory implemented to inform the technical report and manuscripts aligned to the study aims.

  A cross sectional household survey targeting community members in both Kenya and Malawi was conducted to collect quantitative data. Descriptive statistics, which included means, standard deviations, frequencies and percentages and inferential analysis in the form of Pearson's Chi-square tests of association was used for analysis.

- **Study on gender and Intersectionality analysis of tuberculosis pre-treatment loss to follow-up in Eastern Cape Province, South Africa**

  The study is an exploratory qualitative research combining multiple qualitative data collection techniques namely FGDs with community members, IDIs with TB patients who were pre-treatment loss to follow-up, and KIIs with healthcare providers and health services managers, as well as community health workers. Based on the study and country context, the study team anticipated variation by age, ethnicity, marital status, migrant status, and gender identity, as primary stratifiers. This study was conducted across seven sites in two districts of the Eastern Cape province, namely Nelson Mandela Bay Municipality and the Sarah Baartman District.

  Purposive sampling was done to identify participants according to age, geographic location, ethnicity, and gender identity. A total of 10 FGDs was conducted with each group consisting of 11 community members. Three FGDs were conducted with women only, three with men only and four with a mixed group with younger participants. The age of the participants ranged from 18 to 65. Most of them spoke isiXhosa and Afrikaans language. A total of 13 (eight men,

five women) IDIs were conducted with patients living with TB. Ten KIIs with five healthcare workers (four nurses and one doctor), three community health workers, one NGO worker and one ward committee member for health were conducted. All but one of the KIIs were conducted with women, which reflected the nature of the nursing and caring professions in South Africa as a whole. Besides the interviews and FGDs, a desk review was also done to look at existing policy documents related to TB management and care.

The study team used a combination of analytical approaches for data analysis, namely, narrative analysis (interpreting meanings through listening to stories as well as social and cultural referents), thematic analysis (through deductively and inductively identifying sets of data and relations that aid understanding our phenomenon of interest), and elements of "grounded theory". The team have finished analysis on the first 21 transcripts, and the key themes that emerged in the ongoing analysis. The team continue to code and analyse the remaining 13 transcripts and will build into the present analysis and saturate the findings. The interpretation of codes and text is being, and will continue to be, framed within the wider structural, global, economic, historical, and policy contexts, and how these intersect, following the modified Intersectional Gender Analysis Wheel of the TDR intersectional gender toolkit.

Preliminary results under analysis from South Africa focus on normative representations and the role that gender plays within their local communities and culture, awareness and understandings acquired about TB, and the relationship and interaction with healthcare services. A number of policy implications for the research findings include:

- *The need to recognize diverse social and structural factors explaining some of the gendered behaviours.* This study reinforces the importance of advocating for men in public discourse, ensuring available healthcare services. Further should be undertaken without overly or singularly urging that men change their behaviour. The aim is to strike a balance – i) ensure men who must change are held accountable and act under material, structural, and normative constraints; while 2) recognize those who ensuring messaging and interventions do not overlook, erase, or counter them, their intentions, and their circumstances. This represents a major research and action gap.
- *The importance of understanding and addressing mental health challenges for TB patients.* As this study suggests, there is a gap in counselling and mental health support for people diagnosed with TB. The study highlights the importance of understanding contextual factors influencing younger people's access to TB healthcare.
- *The need to critically evaluate TB campaigns from an intersectional perspective* and the need to ensure that campaigns resonate with people's situation and constraints to adopting messages.
- *Social support facilitates treatment uptake*.

TDR MOOC ON INCORPORATING AN INTERSECTIONAL GENDER PERSPECTIVE IN IMPLEMENTATION RESEARCH (IR201en)

TDR ran a MOOC on Incorporating an Intersectional Gender Perspective in Implementation Research in September 2023. The African Regional Training Center in the School of Public Health, University of Ghana with support from. The course attracted more than 500 participants, notably with more men taking the course 51.7% and with more geographical diversity than the previous year, 64% from Africa and 25% from Asia. Most were professionals with a Master degree (45%), or above, and between 31 and 40 years of age. One third of the participants completed the course until the last module and of those 88% that took the assessment passed it and got TDR certification.

The IR201en MOOC session was very successful with increasing interest and demand globally, and the participants were very pleased with the content and administration of the course with more than 85% of the participants confirming that the course has met their expectations. We are of the opinion that majority of the participants were able to gain knowledge on incorporating an intersectional gender perspective in Implementation Research and will be able to positively impact on research in their various settings. Given the interest and success of this course implementation, it will be offered every year onwards, including in 2024.

Remaining risks and challenges

Some of the challenges participants faced had to do with internet connectivity, and their inability to download the videos.

Contributions towards TDR key performance indicators

Partnerships and collaborations: HERD International, Nepal; Makerere University, Uganda; Institute of Health Partners, Bhutan; Institute of Anthropology, Gender and African Studies, University of Nairobi, Kenya; Human Sciences Research Council, Durban, South Africa; Kamuzu University of Health Sciences, Malawi; BRAC James P. Grant School of Public Health, Bangladesh; Jimma University, Ethiopia. Partners include three Social Innovation in Health Initiative country hubs: Makerere University in Uganda, the University of the Philippines; and Centro Internacional de Entrenamiento e Investigaciones Médicas in Colombia.

Leverage created by this project: We managed to raise more than US$ 700 000 of funding from the Sweden International Development Agency (Sida) for the gender and social innovation activities and will build on the success stories to mobilize new funding**.**

Gender aspects and vulnerable populations: All the projects under this ER are working to address specific issues of women, gender and vulnerable population in infectious diseases of poverty in LMICs.

Training: 15 individuals (11 peer researchers and four core researchers) from Bhutan were trained on research methods adopting an intersectional gender lens. Eleven enumerators and two Research assistants (RA) in Kenya, 10 RA in Malawi and two RA in South Africa were trained to conduct the research. TDR MOOC on incorporating an intersectional gender perspective in implementation research: 500 new students took the course in 2023.

Strengthened institutions and/or networks: Research capacities of the institutions were strengthened through learning by doing research activities with TDR technical support and guidance. This ER allowed research institutions to strengthen their own national and regional networks and linkages with the MoH.

Publications: One publication and five additional manuscripts under preparation for journal submission

Results dissemination and uptake: In Bhutan, the findings will be shared with policy makers, the MoH, members of the parliament, relevant NGOs and associated agencies through formal high-level dissemination meetings. A manuscript will be submitted to international peer-reviewed journals for publication. A detailed study report, policy briefs and plans for policy uptake by the government agencies, and awareness materials will also be developed. Efforts will be made to disseminate the study through conferences.

The multi-country consortium of Kenya, Malawi and South Africa Results will share their results with the wider scientific community through presentations at national and international conferences, and through open-access peer-reviewed journal publications and reports. Findings from the study will be shared through community engagement mechanisms to allow for feedback to community stakeholders through community engagement meetings. Advocacy work through various mechanisms at county, national and global level based on the findings of the study will be conducted.

Plans for 2024–2025

The study teams from Bhutan and the Africa consortium will develop manuscripts and submit them to peer-reviewed journals as indicated above. The study teams from Bangladesh and Ethiopia will complete their study by early 2025.

Looking further ahead, this expected result will continue to address and align its objectives and focus with the new TDR strategy and the current TDR strategy on intersectional gender research which complements it. In this sense, starting with the 2024 and 2025 biennium, a focus on gender, AMR and climate change will expand the current efforts on intersectional gender research within this portfolio.

TDR–IR MOOC on gender IR201en will be again offered in 2024 and 2025.

▪ *Workstream: Research for innovation*

This workstream supports research that can fill the gaps when no other practical solution is available

In the past, TDR managed clinical drug trials. However, today a range of different innovations are supported, such as finding new ways to deliver drugs or use diagnostics, some of which were developed by product development partnerships which TDR helped create. This workstream aims to identify gaps in existing tools and advocate for the development or improved surveillance systems for preparedness, monitoring and evaluation. Research for innovation focuses on maintaining the effectiveness of control programmes while building resilience to changing environments, including collaboration and strong joint workplans with other programmes across WHO.

ER 1.1.5 : Directions for development and accelerated access to new tools and strategies

The objective of this ER is to ensure that strategic contributions are enabled through engagement with stakeholders where opportunities to foster innovation, pilot approaches or fill evidence gaps are identified in priority areas that are not addressed by, but complement work in, other ERs.

Progress in 2023

DEVELOPMENT OF A DOCUMENT ON BEST PRACTICES FOR MOSQUITO CONTROL IN BUILD AREAS

Background

Globally, mosquito-borne diseases (MBDs) have a massive impact on the health and well-being of humans. All VBDs combined account for more than 17% of all infectious diseases, causing more than 700 000 deaths annually.[28] The most important MBDs are malaria and viral diseases, such as dengue, chikungunya, yellow fever or West Nile virus, which burden is constantly increasing. Further, the spread of invasive species that act as competent arboviral vectors are posing severe risks to public health.

The underlying causes for the increase in MBDs include globalized trade, mobile human populations (through travel or migration), unplanned urbanization, and climate change. The global trade in goods facilitates the movement of mosquitos by passive transport, thus allowing exotic species to invade new areas.[29] This is especially pertinent for species whose eggs can survive dry periods and that breed in small human-made bodies of water (container breeding). The increased mobility of human populations may result in higher frequencies of infected persons moving from disease-endemic regions, thus acting as potential reservoirs for local disease transmission in presence of suitable vectors. This is currently the main cause of dengue and chikungunya transmission in Europe. Urbanized areas can provide a wide range of breeding grounds for mosquitos, thus bringing these vectors into closer contact with large groups of susceptible human hosts. Climate change creates more favourable conditions for invasive mosquito species and conditions for vector competence improve with rising temperature.

[28] For more information see WHO, *Global vector control response 2017–2030, 2017.*

[29] Reference: Tatem AJ, Rogers DJ, Hay SI. Global transport networks and infectious disease spread. Adv Parasitol. 2006;62:293-343. doi: 10.1016/S0065-308X(05)62009-X. PMID: 16647974; PMCID: PMC3145127.

Objectives of the document and expected outcomes

The document aims to provide evidence-based best practice to policymakers and mosquito and pest control professionals for the built-up development environment. This expands on recommendations made in previous publications that focus on surveillance and control of invasive and native mosquito species in the European region. The document will include a critical assessment of available practices for surveillance and control to make specific, evidence-based information available to policymakers and vector control professionals. It will incorporate input from other regional experts with a **specific focus on *Anopheles stephensi*** as a recently emerged invasive urban vector species in Eastern Africa.

The main objectives of this document are: i) the critical analysis of available methods and tools for mosquito control in built-up areas; and ii) the building up of strategies adapted to specific requirements, while complying with international recommendations/regulations, and in line with the Global Vector Control Response (2017–2030).

Expected outcomes:

- Promotion of the use of integrated vector management in built-up areas, with available tools
- Preparation for the use of innovative tools in vector control
- Reducing of vector resistance to biocides
- Control of high population mosquito densities in built-up environments, thereby reducing nuisance and risk to human populations
- Monitoring protocol to prevent and/or slow the spread of invasive mosquito species
- Reduction of risk of MBD outbreaks, and adequate response to the occurrence of MBDs
- Reduction of the overall MBD burden
- Increased citizen engagement in monitoring and control, e.g. citizen-aimed campaigns to prevent invasive mosquito spread via private vehicles, or campaigns to reduce stagnant water at private properties.

Remaining risks and challenges

Nothing major anticipated.

Contributions towards TDR key performance indicators

Partnerships and collaborations: with the European Mosquito Control Association. Best practice document will create opportunities for strategic partnerships with stakeholders of vector control.

Leverage created by this project: None

Gender aspects and vulnerable populations: promotes mosquito control in urban areas through community engagement.

Training: No training involved at the moment.

Strengthened institutions and/or networks: none yet

Publications: A document will be published.

Results dissemination and uptake: Planned

Plans for 2024–2025

Publication and dissemination of the Best practice document. Opportunities for testing implementation and optimization for scale-up will be explored.

ER 1.3.10: Urban health interventions for the prevention and control of vector-borne and other infectious diseases of poverty

Accurate, consistent and evidence-based interventions for prevention and control of infectious diseases of poverty in urban settings are urgently needed to implement cost- effective public health policy and to promote inclusive, equitable and sustainable urban health systems and services. Understanding the social dynamics, including the gender dynamics that take place in the urban context, is needed to address bottlenecks in the implementation of effective interventions and strategies and to better understand the differentiated impacts of infectious diseases on various population subgroups and how gender intersects with other social stratifiers to better understand different experience of disease.

TDR has a history of supporting research on the impact of gender dynamics and inequalities that influence prevention and control efforts of infectious diseases of poverty in LMICs, including in urban settings. In response to TDR's call for proposals, two multidisciplinary research teams from Bangladesh (Health System and Population Studies Division, icddr,b), and India (Indian Council of Medical Research (ICMR), Regional Medical Research Centre) have conducted literate reviews that will inform a new call for research proposals to start in early 2024 and strengthened regional networks in the Asian Region. The overall objective of this activity was to synthesize and consolidate evidence from a series of literature reviews and state-of-the-art scoping reviews that will inform TDR's research agenda on urban health, infectious disease and gender research, including in COVID-19 and post-COVID-19 scenarios to the extent possible.

Progress in 2023

Both the study teams in India and Bangladesh completed the systematic reviews in 2023 and undertook various activities to disseminate the results from such reviews, including stakeholders meeting at national levels.

Indian Council of Medical Research (ICMR)

As a result of the systematic reviews, the research team have published four articles in peer-reviewed journals, submitted a fifth manuscript for publication and have developed two evidence briefs for dissemination.

The paper entitled "Gender dimensions of health-related challenges among urban poor during COVID-19 pandemic in LMICs: a systematic review and gap analysis" (Sahoo et al. 2023, see Annex 1) describes the gender dimensions of health-related challenges among the urban poor during COVID-19 in LMICs. The results showed that COVID-19 pandemic increased vulnerability among the urban poor in LMICs. The risk was often compounded by their poor living conditions, loss of income, and food insecurity – such deprivation frequently associated with gender-based violence, which affected health outcomes such as COVID-19 care and prevention, routine healthcare, reproductive healthcare, and psychosocial health. Furthermore, the studies revealed a wide range of resilience strategies among urban poor. The impact of vulnerability was also influenced by four factors: the type of urban poor, gender, gender identity, other social determinants such as age, education, caste/ethnicity, and individual socioeconomic status. Furthermore, the studies revealed a wide range of resilience strategies among the urban poor.

While the severity of the pandemic varies by sex and gender identity, their vulnerability also varies by caste/ethnicity, literacy, and economic status, which suggests the importance of focusing on how and why gender intersects with other social variables under structural conditions of disadvantages and discriminations. The findings also imply that in-depth research on emergency vulnerability among the

urban poor is required – a broad range of social determinants and their intersections that influence their health and disease experience.

Research gaps identified from the systematic reviews:

- There is limited information on sex-segregated data or studies on the gender dimension of health among the urban poor during any emergency in LMICs.
- Need for research on the effectiveness of community engagement initiatives, including the role of different stakeholders and the challenges and opportunities of these interventions.
- More research required on the gender-specific impacts of COVID-19 on water use, sanitation and hygiene (WASH) practices among the urban poor, including the effectiveness of gender-sensitive interventions and how gender intersects with other social determinants of health.
- Need for research on the housing-related challenges faced by the urban poor during the pandemic, including the effectiveness of housing interventions and how gender intersects with other social determinants of health. Addressing these research gaps is crucial to inform effective policies and interventions to support vulnerable populations during the pandemic and beyond.
- There were limited studies on the non-binary gender population in the COVID-19 context in LMICs, which indicates the need for more research among these populations.
- Lack of quantitative studies on social and cultural beliefs prior to, during, and after the pandemic were noted in the context of LMICs.
- To address these gaps, future research could focus on conducting gender-sensitive analyses of the mental health impact of pandemics on gender-diverse populations. Additionally, studies could investigate the unique challenges faced by sex workers and refugees during public health emergencies, and the role that gender plays in their experiences.

Dissemination activities:

The team from India conducted two dissemination sessions with various stakeholders. The first was held on 6 April 2022 with 55 participants from government and non-government agencies, as well as UN agencies, academia and representatives from the slums and transgender population. A session was held with community members, a women's self-help group, and trans men and women who shared their experiences related to gender-based violence, WASH, and housing challenges during COVID-19. This was followed by two separate group discussions with the stakeholders on WASH, housing-related challenges and opportunities, and tackling gender-based violence during an emergency among the urban poor.

On 23 November 2022, the team conducted another dissemination workshop with various stakeholders to disseminate the study findings. Forty-five participants from government and non-government organizations participated. During this workshop, they also conducted a panel discussion with seven key panellists with the discussions focusing on WASH and housing among the urban poor in COVID-19 context along with the preparedness to tackle future health emergencies. The discussion from both the workshops and engagement with various stakeholders helped the research team to develop policy briefs.

Currently, TDR is supporting the team from India for a separate cross-sectional study among urban poor population, which aims to explore trends of soil-transmitted helminths infection among urban poor children (aged five to 12 years) and pregnant women in Odisha, India with an intersectional gender lens.

icddr,b team, Bangladesh

The icddr,b team conducted a systematic literature review on social determinants of urban health and identified effective community-based interventions to prevent and control infectious diseases in urban informal settlements. As a result, they developed two manuscripts and two evidence briefs as detailed in the supplementary file.

The team also conducted a stakeholder listing and mapping, informal meetings with stakeholders, stakeholder consultation workshops and developed a draft policy communication material. Lastly, based on these findings a policy dialogue was held with the policymakers and relevant stakeholders to share these findings and identify recommendations for policy uptake on the social determinants of urban health in Bangladesh. The key stakeholders were from various relevant organizations in Bangladesh, including Institute of Epidemiology Disease Control and Research, Ministry of Health and Family Welfare, Ministry of Local Government, public representatives including Ward Commissioners, Politicians and Ex-mayors, municipal authorities, healthcare professionals, researchers, academics, development partners and members of civil society, public and private sector.

Stakeholder consultation workshops

The team organized two stakeholder consultation workshops to disseminate the study results among the stakeholders in urban Bangladesh. Through the workshops, implementation research priorities were established and feasible programmatic entry points to translate research-based evidence for strengthening the health system around improving nutrition and infectious disease prevention and control in urban settings under climate change conditions were identified. Table below shows the recommendations from the stakeholder workshops:

Table 5. Recommendations for community-based intervention and innovations for the prevention and control of infectious disease in urban Bangladesh

Prevention measures	Control measures	Taking intersectional and gender transformative approaches
Health Education, especially focusing on life cycle approaches.	Improve access to healthcare and screening facilities	Intersectional and gender transformative approaches
Community-engagement, women and youth groups	Health education on self-care	Capacity enhancement and cross-linking city corporations and specific ministries
Slum-specific environment intervention and prevention	Provide specific logistics support such as mosquito nets	Leadership skills and direction
School health education focusing on prevention and awareness	Early notification of cases	Activation of existing facilities and facilities conduct implementation research
Provision of logistics and continuous monitoring of programmes	Address bottlenecks in service delivery	Integration of urban health components in relevant ministries
Prepare need-based and appropriate communication materials		

After two stakeholder consultation workshops were held, the project team arranged a policy dialogue with high level stakeholders to discuss the findings of the systematic reviews, recommendations and policy implications as below:

Key discussion points

- Besides the government, a positive approach by the citizens through community support, engagement and social mobilization, coordination and behavioural change can promote a positive health outcome which is needed to prevent and control infectious diseases in urban settings.
- Advocating to the government regarding the challenges faced for availing health services, disparity among different classes and disadvantaged people (specifically women) to avail health services and sharing the scope of improvements.
- Community support groups to locate the ones who are unable to reach to the community clinics were highlighted. Health is affected by other determinants which can be addressed by multi-sectoral engagement. Effects of food adulteration, food safety was emphasized.
- Need for public health professionals to assist the urban planning engineers and other stakeholders to properly execute urban planning was highlighted.
- Stewardship for promoting the health services among people more responsibly. Career progression health officers and doctors who are posted in urban health primary healthcare services was also discussed.

Recommendations

- To create an operational plan based on the identified gaps and future commitments from the higher authorities was emphasized.
- Increasing awareness to improve health seeking behaviour among the people and to motivate the medical professionals who see a slow career growth in rural community clinics.
- Multi-sectoral engagement needed to see better health outcomes.
- To bring a structural change by creating a comprehensive planning for the urban areas of each division of Bangladesh.

Policy Implications

The workshop and dissemination activities helped to address key challenges in urban settings before, during, and after the COVID-19 pandemic and highlighted urgent need of further research, evidence generation and gender sensitive policy development in the urban health sector. Through these workshop and dissemination activities, the study team successfully and meaningfully engaged with high level stakeholders to leverage their commitment to incorporate an intersectional gender approach into the current policy landscape for preventing and controlling infectious diseases in urban Bangladesh.

Remaining risks and challenges

The teams still faced challenges due to covid, however slight delays were overcome thanks to the efforts from the research team members.

Contributions towards TDR key performance indicators

Partnerships and collaborations: Health System and Population Studies Division, (icddr,b), Bangladesh; and the Indian Council of Medical Research (ICMR), Regional Medical Research Centre.

Leverage created by this project: TDR will build on the productive results to mobilize new funding and link up with the environmental and climate work domains within the new TDR strategy to develop funding proposals.

Gender aspects and vulnerable populations: The Principal Investigators in both the countries are women. The thematic of this expected result consider gender dimensions as a core element of focus.

Training: No specific training.

Strengthened institutions and/or networks: Research capacities of the Institutions and national stakeholders within the MoHs were strengthened through learning by doing research activities with TDR technical support and guidance. This ER allowed research institutions to strengthen their own national and regional networks and linkages with the MoH in urban health with a gender and equity lens.

Publications: Four

Results dissemination and uptake: The team from India conducted two stakeholder dissemination meetings, developed two policy briefs, published four research articles in peer-reviewed open access journals and submitted one manuscript for publication in a peer-reviewed journal.

The team from Bangladesh conducted two stakeholder dissemination meetings, one policy dialogue event with high-level stakeholders, developed two policy briefs, submitted two manuscripts in peer-reviewed open access journals.

Plans for 2024–2025

In 2023, the last manuscripts are expected to be published before the end of the year, including a literature review on gender-based violence and urban health.

In addition, TDR is working with the research team from India, conducting a mapping of policies, programmes, and budgets to respond to urban health challenges identified and clarify the gaps that IMP evidence will fill in relation to potential changes in policy, strategies, guidelines, programmes, and budgets.

In 2024 a call for research proposals will be launched, focusing on the research gaps and results highlighted in the reviews.

ER 1.3.14 : Testing of innovative strategies for vector control

Introduction

VBDs such as malaria, dengue, Zika, chikungunya, yellow fever and others account for 17% of the total morbidity from infectious diseases, causing more than one million deaths per year, with few new drugs or strategies to combat these emerging infectious pathogens. The incidence of some VBDs has grown dramatically in recent decades, with about one third of the world population now at risk from *Aedes*-borne epidemics. The rationale of this Expected Result is to work with all partners to test innovative vector control technologies. Among the current alternatives for new vector control technologies the Sterile Insect technology (SIT), a method of pest control using area-wide releases of sterile males to mate with wild females which will thus produce no offspring, has been successfully implemented in agriculture since about 60 years, with no side effects and an environmentally safe impact. To test this innovative technology against the diseases, a technical collaboration was established in 2019 between the International Atomic Energy Agency (IAEA), the WHO Neglected Tropical Diseases Department (WHO–NTD) and in 2021 with the Centre for Diseases Control from US (CDC) becoming also a funding partner.

This Expected Result aims to provide countries and stakeholders up-to-date guidance on how to test new vector control technologies through different materials such as a guidance document, training materials, workshop and in-site evaluations. Research activities under the best standards of quality and ethics will also be implemented through to test into field conditions the entomological outcomes and the epidemiological outcomes of new vector control technologies. To support the implementation of this project at best, supplementary activities are included on capacity building and relevant tools.

The project started in 2019 through a MoU with the IAEA that was ended in July 2023. The future timeline for the SIT project is provided below and based on the partnership established:

Years	*Activities*	*Outputs/Outcome*
2021–2022	Partnership develop with US CDC	Agreement signed
2022–2024	Field testing of SIT in three countries	Workshop in WPRO in 2023
2023–2024	Engagement with WHO VCAG	Outcome from VCAG
2024–2025	Results from field testing	Adoption of SIT by countries

Progress in 2023

PACIFIC ISLANDS CONSORTIUM FOR THE EVALUATION OF *AEDES* SIT (PAC-SIT)

Research project, contracted in June 2023

Abstract: The Pacific region is experiencing a high burden of mosquito-borne disease, with concurrent epidemics of dengue, chikungunya and Zika virus infections occurring since 2012. These outbreaks are exacerbating the pre-existing burden Pacific Islands primary healthcare systems face and are directly impeding the achievement of the World Health Organization (WHO) Sustainable Development Goals (SDG) in the region. The constraints inhibiting the prevention and response to arboviral outbreaks in small Pacific Island countries are many, particularly the limited capacity for mosquito control especially against *Aedes aegypti*, *Aedes albopictus* and the Pacific tiger mosquito *Aedes polynesiensis*. These container-breeding species which use small, dispersed, and sometimes cryptic habitats as oviposition sites are particularly difficult to control using standard methods. The assessment and integration of innovative mosquito control approaches, including the Sterile Insect Technique (SIT), against *Aedes* vectors is thus urgent. Islands are tractable places for scientists to assess the efficacy of novel technologies such as the SIT. The Pacific Islands consortium for the evaluation of *Aedes* SIT (PAC-SIT), led by Institut Louis Malardé in Tahiti, French Polynesia, will engage three Pacific Island countries and territories (Cook Islands, Easter Island and French Polynesia) and their communities in a programme evaluating the safety, acceptability, and efficacy of SIT within various locations. Following initial testing and validation of standardized production, sorting, and sterilization protocols in the laboratory (Tahiti facility), release interventions will be undertaken at two locations (targeting transmission areas where vector intervention is appropriate in Aitutaki and Tahiti islands) in a culturally relevant approach engaging Pacific Island communities. Monitoring of the SIT efficacy before, during and after intervention will rely on standard as well as new entomological indicators of epidemiological relevance namely, the detection of pathogens in mosquitoes to assess risk of disease transmission, and the monitoring of biomarkers in human cohorts to measure the decreasing exposure to mosquito bites resulting from the SIT-induced population suppression. Operational implementation of the SIT in these contrasted Pacific Island settings will allow the assessment of SIT regulatory constraints and cost effectiveness (US$/ha/year) including in the context of trans-national transport of sterile males (Tahiti to Cook Is.). The SIT facility in Tahiti will serve as a training platform for regional partners, especially the Easter Is. team, to increase the success of their future SIT intervention (which is outside this project's scope). The PAC-SIT consortium will leverage the expertise of local health and vector control coordinators, community leaders, international scientists, as well as stakeholders from the luxury hotel resort industry in a trans-sectorial approach designed to strengthen the sustainability of the SIT at larger intervention scales.

The research project was conditionally approved by WHO Ethics Review Committee in May 2023 and received full approval on 19 October 2023.

SUPPORTIVE ACTIVITIES

CAPACITY BUILDING ON MEDICAL ENTOMOLOGY

A directory of courses on medical entomology developed previously by TDR is now fully available online hosted by the ***Global Vector Hub (GVH) platform***, to reach the global community under the names Global Atlas of Medical Entomology Schooling (GAMES) directory.[30] The GVH partner has been contracted to maintain and further develop the GAMES directory over a two-year period and the programme of work includes the following activities:

1. To carry on the maintenance of the current site with regular monitoring of the GAMES course directory on the GVH to ensure that sites on the directory are active and that any identified updates or errors are rectified.
2. To develop an interactive map as an alternative means of browsing courses in the GAMES resource. Map to be divided into WHO regions to help users find courses in their country or regions.
3. To integrate additional courses according to the request of the institutions and course responsible officers. This will be done through a standard operating procedure detailing methods for selecting courses to be added to the database and outlining specific inclusion and exclusion criteria.
4. To support a scoping analysis on the opportunity to establish Reference Centres for training in medical entomology. This activity will include the setting up of a working group of experts under the TDR rules and processes and the development of a document providing the criteria and potential Terms of References for the future Reference Centres.

Activities 1 to 3 were completed in 2023 and *technical reports are available upon demand*, and Activity 4 will be completed by end 2023.

A meeting between the experts for finalizing the Terms of References for Reference Centers with CV on medical entomology courses will be held on the 6 November 2023, as a side event of the EMCA (European Mosquito Control Association) Conference to be held from 7 to 10 November 2023, in Palma de Majorca, Spain.

LANDSCAPE ANALYSIS ON INNOVATIVE VECTOR CONTROL TOOLS

The landscape analysis is under external review for a publication as a TDR document on the TDR website by end of 2023.

DATA SHARING ON VECTORS AND BIODIVERSITY OF VECTORS

Because of the success of the first edition and the importance of adequately sharing data on vectors, a second open call is supported by TDR in 2023, in partnership with the Global Biodiversity Information Facility (GBIF), for a special issue in the GigaByte Journal for data papers on vectors. This publication will be released in October 2023.

The collaboration with the GBIF is encouraged because it is one of the few (the unique maybe) joint activities between WHO and the Convention of Biodiversity, since Biodiversity loss has an impact on health, which not well known and understood.

A training workshop on data sharing on vectors will be supported by TDR as a 2-day side-event from 24 to 25 November 2023 of the Asian Mosquito Vectors Conference to be held in Chiang Mai, Thailand, from 26 to 30 November 2023. The list of participants from LMIC (Low or Middle Income Country) supported by TDR include 10 countries.

[30] This directory has the objective to help countries to build up capacity on this specific discipline for all levels, from the basic technical level to Ph.D. students, and can be found at the following link: https://globalvectorhub.lshtm.ac.uk/menu.

Remaining risks and challenges

The main risk for this ER was due to the lack of funding after the COVID-19 pandemic, which has disrupted the attribution of funds and reorientated them for diseases other than VBDs. Fortunately, this risk was mitigated through the funding support from the US CDC, which is now securing this activity for at least SIT field testing in one region and three countries.

The remaining challenges are to raise more funding for supporting at least one more consortium from a different region since four consortiums were originally selected. Interactions with different partners continue.

Contributions towards TDR key performance indicators

Partnerships and collaborations: For the SIT field testing, a technical collaboration was developed with: the International Atomic Energy Agency (IAEA); the joint IAEA/FAO Team; WHO–NTD; WHO Regional Offices; and the Arboviral Diseases Branch of the US Centre for Disease Control (CDC). The SIT consortium from the Pacific Region will be working with the research institutions of French Polynesia, the Cook Islands and Easler Island (Chile), as well as the WHO Country Offices and the Ministries of Health. For the capacity building, a partnership was established with ARCTECH Innovation (UK) managing the Global Vector Hub Platform, where the directory of courses on medical entomology is currently online. For data sharing, a collaboration was established with the Global Biodiversity Information Facility (GBIF), a Programme from the Convention of Biodiversity.

Leverage created by this project: This project has leverage designated funds for a total amount of US$ 800 000 for SIT field testing, funded by the US CDC. The countries involved in the projects have already committed to co-support the field testing through their own vector control agencies funding, through staff and materials for an amount which has been estimated to be at least equivalent to the funding received. Another leverage will be made through the direct support to the sterile mosquito production facilities by the Technical Cooperation department from IAEA for about the same amount. The total leveraged by this project is thus about US$ 1.5 million. Co-funding of the training workshop on data sharing by GBIF leveraged about US$ 50 000 on this activity.

Gender aspects and vulnerable populations: For the SIT project, gender aspects were taken into account in the selection process since all consortiums are showing parity among the investigators (50% of men and 50% of women). The selected consortium from the Pacific Region has a research team composed by 11 persons (five men, six women) with a parity rate of 54%. The parity in gender is also well respected within the Ad-hoc Review Committee including three women and three men, and finally the management team (IAEA/NTD/CDC/TDR) include 10 persons (4 men, six women).

This new vector control technology does not address specifically vulnerable populations, however it is well recognized that arboviral diseases are affecting more strongly the more poor and vulnerable populations, as this was well demonstrated during the Zika pandemic. The SIT will be deployed in priority areas where the most affected populations are the poorest and the most vulnerable.

For the activities on medical entomology courses, the gender balance of the GVH is 50% (with one woman a principal investigator and one male), the gender balance for the selected working group is also 50%, with 50% coming from LMICs.

For the activities on data sharing on vectors, the gender balance for the supported trainees is 60% (seven women and five men). All activities will have direct benefits on the most vulnerable populations with improved access to capacity building on vectors.

Training: The SIT training workshop held in Tahiti in May 2023 included 39 participants from 20 countries. The Global Vector Hub directory for courses in medical entomology includes 162 courses worldwide and the directory has been opened by several 1,000 of users. A survey showed that the database is a useful resource (on a scale of 1-not useful to 10-useful, users voted an average of 8.4). And the directory is easy and user friendly (on a scale of 1-not useful to 10-useful, users voted an average of 8.2). The data sharing training will be delivered to 20 participants, half of them from LMICs, directly supported by TDR.

Strengthened institutions and/or networks: The research institutions from French Polynesia, Cook Islands and Rapa Nui (Chile) will be strengthened by the SIT research project. The Global Vector Hub network on medical entomology training is strengthened through the online directory. The GBIF platform on data sharing for vectors is strengthen through the support for publications and the training.

Publications: 9

Results dissemination and uptake: Development of the dissemination plan for SIT project on track. Presentation at VCAG for WHO recommendation. Presentations of activities at international conferences. Scientific Publications. Engagement with stakeholders from countries. Presentation of activities at the Annual Events of the partner Agency such as GBIF30 Governing Board in October 2023.

Plans for 2024–2025

- Continuation of SIT field testing
- Follow up with VCAG and update on results
- Follow up with eventual WHO recommendation and deployment of SIT in countries
- Continuation with the online GAMES directory
- Follow up with WHO on the Reference Centers for training in medical entomology
- Publication of the Landscape Analysis on Vector Control Tools
- Continuation of collaboration with GBIF for data sharing on vectors

▪ *Closing workstream: Research for integrated approaches*

The main aim of this workstream is determining the complex interactions between people and their environment that affect disease transmission.

In this area of work, TDR supports a holistic, integrated multisectoral approach that helps populations build resiliency to current and future challenges. This includes, among others, research expertise in climate change, biodiversity loss, biological threats, agriculture and societal changes. This approach helps to address parasite and vector resistance to today's tools, and geographical expansion of the diseases, particularly into urban environments. It informs how effective integrated multisectoral responses can be implemented to address these challenges.

This is an approach that all projects prioritize as context permits. The TDR Strategic Plan 2024–2029 emphasizes that experience has shown the importance of cross-cutting, multisectoral and One Health approaches to tackling diseases. Maintaining focus on human diseases, TDR will continue to engage health-related sectors such as water, agriculture, housing and education. Efforts will continue to work across silos applying systems thinking to understand the complex interactions between humans, animals and their shared environment in driving human diseases of poverty and seek solutions through multidisciplinary collaboration.

ER 1.3.11: Multisectoral approach for prevention and control of malaria and emerging arboviral diseases

Background and context

Vector-borne diseases (VBDs), including malaria and emerging arboviral diseases, account for about one quarter of all infectious diseases. Although there has been noteworthy progress for malaria, with a recent decrease in malaria morbidity and mortality rates, other diseases, such as those caused by arboviruses like dengue, chikungunya, yellow fever and more recently Zika, are expanding, with an increased number of cases and geographical distribution. It has become evident that the prevention and control of these diseases must include more than a single orientated approach, since the transmission patterns are driven by vector host-pathogens relationship where natural conditions, human societies and vector parameters are dynamically interacting. Further, the Global Vector Control Response 2017–2030, which was approved at the World Health Assembly in 2017 by more than 190 Member States (WHO 2017) considers the intra- and intersectoral approach as one of the four pillars to achieve efficient vector and VBD control.

The rationale of this expected result is to better understand how to implement an efficient multisectoral approach (MSA) for preventing and controlling VBDs since although MSA has been widely used and recommended, the theoretical baselines and the "*how to*" are missing. This ER will also work on developing tools, framework, and guidance on MSA as well as test the approaches with case studies in field conditions.

This activity started in 2016 as a collaboration on MSA for the prevention and control of malaria and emerging arboviral diseases between TDR, the Swiss Development Cooperation (SDC) and the Canadian International Development and Research Centre (IDRC) to build a multi-disciplinary approach. Following these first steps a collaboration was established in 2019 with WHO–WASH and supported by funding from Sida to strengthen countries' capacity on MSA against VBDs with a focus on WASH. Finally, the relevance of the MSA against malaria allowed for a collaboration with the Global Malaria Programme (WHO–GMP) and the National Institute of Poverty Diseases from China (NIPD) through funding from the UN Peace and Development Sub-Fund (UNDESA) to test new approaches on malaria control in four African countries (Burkina Faso, Senegal, the United Republic of Tanzania, and Zambia). Most of the case studies supported through this project will end by December 2023, but the Expected Results is planned to continue for at least two more years (2024 and 2025) to extract the lessons learned and develop more material such as a training course for guiding MSA implementation. All collaborations developed with different partners for this project were technical and financial and a summary of the steps within this overall project is provided below:

Years	*Activities*	*Outputs/Outcome*
2016–2017	Building partnership around MSA	Workshop in Geneva
2017–2019	Commissioned reviews supported	Special Issue published
2018–2020	Development of a Framework	Document published
2019–2022	Collaboration with WHO–WSH	3 Case studies, two completed
2021–2023	Collaboration with WHO–GMP	1 case study, Training Workshop

Progress in 2023

CASE STUDY 1 – A pilot multisectoral intervention for controlling malaria vectors, mitigating insecticide resistance, and assessing WASH facilities at healthcare units in selected coastal and west Sahelian African countries.

Abstract and Main Results until June 2023 (project ending in November 2023) (More details in Supplementary File)

Apart from the classical malaria control interventions, the study proposes a new holistic multisectoral approach for addressing residual malaria in this research. Working with a team of scientists from ***public health***, ***environment***, and ***agriculture*** (One Health approach), as well as other public and private sectors (***education***, ***community participation***, ***market for bed nets***, and others), the focus will be on malaria vector control in targeted hotspots such as rice fields, riverbeds, and vegetable farms. **WASH** facilities will also be investigated at healthcare facilities in target study sites. The proposed research activities will contribute to the reduction of vector densities and the mitigation of insecticide resistance in the Anopheles populations in the selected hotspots. Activities will also conduct insecticide residues checks on bed nets collected at the point of sale in markets to ensure their effectiveness prior to field use for mosquito control. This study will also present current WASH practices at the community level in the four project countries to gather preliminary information for future interventions in this field.

Four hypotheses form the basis of this proposed multisectoral approach for malaria vector control:

- (H1) The reduction of mosquito densities through community participatory activities and multisectoral interventions (Agriculture, Environmental, and Health) in selected hotspots such as rice fields using proven agronomy practices coupled with physical modification/destruction of Anopheles breeding habitats in riverbeds during the dry season will improve the control of this disease towards its elimination.
- (H2) The effective use of agricultural insecticides for pest control will reduce the presence of residues in mosquito breeding sites and contribute to mitigating the observed spread of insecticide resistance in malaria vectors.
- (H3) The quality check of insecticide levels in LLINs (long-lasting insecticidal nets) sold in markets will improve the performance of this tool used for malaria vector control.
- (H4) Documenting current WASH practices will contribute to improving these conditions in healthcare facilities for improved quality of care, reduced risk of nosocomial infectious disease transmission, and reduction of mosquito breeding habitats.

Objective 1 – To reduce by more than 50% the densities of Anopheles breeding sites and larval densities in riverbeds during the prolonged dry season in Mali.

Results **–** Adult mosquitoes were collected every two weeks using pyrethrum spray catch in parallel in 20 human dwellings of each of the localities of the intervention and control portions of the riverbed to estimate mosquito density. This allows us to estimate the effects of the different interventions (larval habitats destruction and/or treatment with BTi, and mosquito swarm killing) on the entomological parameters of malaria transmission by comparing the intervention and control portions of the river. ***Mosquito's densities were reduced by 66.7% and 61.1% in the intervention portion compared to the control one in March and April 2023***, respectively.

Objective 2 – To reduce by more than 50% the quantity of insecticide residues in soil and water (Anopheles breeding sites) compartments in vegetable production sites.

Results – Even at low doses, ***insecticide residues in soil could contaminate runoff and select for insecticide resistance in non-target organisms like anopheles, a major malaria vector***. The high level of insecticide residues (emamectin benzoate) in cabbage farming was the consequence of the misuse of insecticides and cabbage leaves that do not allow sunlight to easily destroy insecticides. Such a situation could pose serious health issues.

Objective 3 – To improve (through quality checks) by more than 50% the effectiveness (bio-efficacy and recommended insecticide residues) of the LLINs obtained at the point of sale in the communities.

Results – Insecticide-treated nets are readily available at point-of-sale in Lagos, Nigeria however, most of the available nets are deltamethrin-treated nets. All the available nets are effective against susceptible laboratory strains of *Anopheles gambiae* 24-hour post-exposure and alphacypermethrin-treated nets have the highest knockdown ability. Samples of the nets are being processed using high-performance liquid chromatography with diode-array detection (HPLC-DAD) protocols for screening collected samples for insecticide residue estimation.

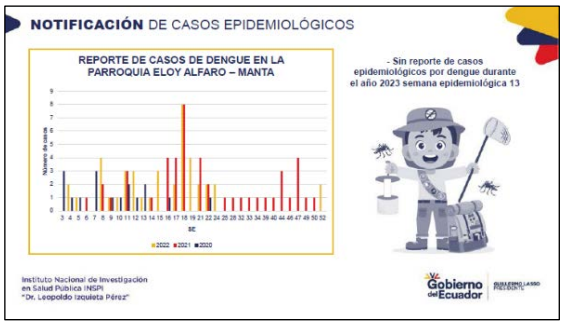
Objective 4 – Assessment of WASH facilities and practices for improved reduction of infectious diseases transmission at healthcare units – Burkina Faso.

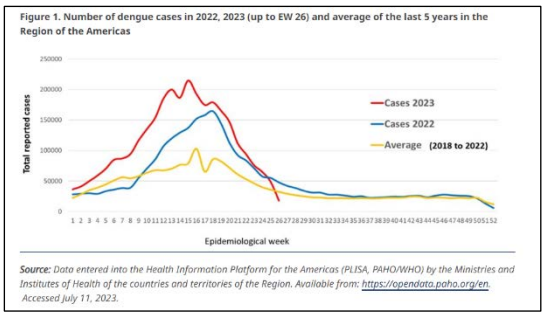
Results – The results show the ***weakness of WASH services in health centres. Latrines and toilets are inadequate for most users and the hand-washing facilities were absent***. Respondents have some knowledge of VBDs and Anopheles was cited as the main vector of malaria, which proliferation was attributed to vegetation, water channels, puddles, and rice fields.

CASE STUDY 2 – Establishment of a multisectoral strategy integrating Health, Environment, Education, Sanitation and Water sectors to control and reduce mosquito populations in order to prevent transmission of *Aedes*-borne diseases, in the city of Manta, at the coastal region of Ecuador.

Presentation of the project (ended in June 2023)

Results





Situation of dengue in the Americas at Week 13, 2023, peak of the dengue epidemic.

CASE STUDY 3 – Zika, Dengue and Chikungunya: Multisectoral approach for developing solutions applicable in public health

Abstract and main results (project ended in July 2023)

This study brought together a multidisciplinary team from different institutions that focused on the Zika virus, chikungunya and dengue and the correlation to entomological and socioeconomic factors over the last few years. Project inception was in response to the demand from Brazilian society regarding *Aedes aegypti* mosquitoes and associated viruses. This study focused on Estrutural City, Brazil's poorest city (historically hosting the largest open dump in Latin Ameria), and the second largest city in the world for the past 60 years. The study focused on three objectives: 1) analysing the sanitation conditions in two different areas of Estrutural City, including selective waste collection and water quality; 2) analysing the population density of *Ae. aegypti* and develop a strategy for the identification of mosquito species; and 3) carrying out qualitative research and developing a health education approach to provide the population of Estrutural City with a better understanding of their needs and knowledge about sanitation.

This multisectoral approach included the health sector and communities, ***waste, sanitation and hygiene services***, and the ***education sector.***

This city was divided into two areas for comparison: Area A- with no sanitation cover; Area B- with sanitation cover. A total of 60 houses (30 from each area) were sorted to participate in the study. Water tanks were also delivered, and waste containers and bags in area A to support the proper disposal of trash and waste. The collective health activities were conducted in 15 day-care centres with parents, children, and teachers, in Resident`s Associations with the community, and in the city's Health Care Center with users of the Public Health System. Health education was provided and water quality was analysed (physical and biological parameters). The population density of *Ae. aegypti* was measured during 11 months in both Areas and results compared with the baseline.

Houses in Area A showed poorer conditions in comparison with B, with more debris in or around (A:80%, B:57%), open sewage disposal (A:20%, B:3%), wooden houses (A:43%, B:3%) and ground water reservoirs (A:30%, B:10%). Water quality results indicated total coliforms and E. coli were detected in high concentrations in Area A, showing that people who live in this area are more vulnerable to water-borne diseases. The main findings of the project were:

- There was ***high frequency and density of Ae. aegypti*** in a very poor city in Brasilia after an entomological survey in 60 houses during 11 months, showing that mosquito density and frequency is influenced by sanitary conditions and also that water quality is poor in the study area.

- A new strategy was developed for morphological identification of Culicidae in system (CULICIDEX) for 11 genera and 26 mosquito species.
- People were very receptive and interested in sharing knowledge to change their habits to promote health. ***One particularly good outcome was the decrease in dengue cases*** in the area since the beginning of the project, as reported by the communities.

These findings and actions will provide new control alternatives for arboviruses in risk areas and contribute to continued public health policies and basic services to be provided to the vulnerable communities.

CASE STUDY 4 – Approches multisectorielles pour lutter contre le paludisme au Burkina Faso : étude des différents secteurs dont l'activité a un impact sur la transmission du paludisme et mise en place d'une coordination multisectorielle pour implémenter et évaluer au moins une activité jointe permettant de diminuer la transmission

Résumé

Les objectifs de cette étude de cas sont de développer les outils et les approches permettant de garantir la participation de différents secteurs d'activité (autres que la santé) à la lutte contre le paludisme au Burkina Faso. Cette étude sera basée sur le cadre conceptuel développé par TDR et publié en 2020 qui recommande l'établissement de la liste des secteurs concernés, l'analyse des besoins et impacts de chaque secteur, la mise en place d'un comité de coordination multisectoriel et l'implémentation d'activités jointes bénéficiaires à la fois aux secteurs participants et aux populations par une diminution de la transmission du paludisme.

Les résultats attendus de cette étude de cas sont donc la réalisation de la liste des secteurs (autres que la santé), tels que l'agriculture, l'énergie, le développement des infrastructures, et d'autres qui ont un impact sur la transmission du paludisme. Cette liste doit également inclure les secteurs dont l'impact n'est pas matériel, tels que l'éducation. Un second résultat attendu est l'analyse des avantages directs (économiques et autres que la santé des populations) pour ces secteurs afin de les inciter à participer activement à la prévention et la lutte contre le paludisme.

Ces résultats seront ensuite utilisés pour tester la mise en place sous l'égide des autorités d'un Comité de Coordination Multisectoriel qui comprendra des représentants des divers secteurs concernés. Ce comité peut/doit s'appuyer sur des structures existantes. Ce Comité pourra être testé et validé en proposant une activité multisectorielle jointe, dont les résultats seront analysés non seulement en termes de réduction de la transmission du paludisme, mais également en termes d'avantages pour les secteurs participants. Cette étude de cas se conclura par un rapport technique d'activité et des recommandations sur les approches multisectorielles, pour un déploiement plus large de ces approches.

Objectif 1 – Identifier les secteurs non-santé qui pourraient apporter un appui dans la lutte contre le paludisme en 2022.

Résultats – Les secteurs contactés et interviewés sont les suivants: Education, Transports, Urbanisme, Eaux et Hygiène, Economie and Finances, Agriculture, Environnement and ONGs.

AMBF (Association des municipalités du Burkina Faso)	Mairie	Chargé de communication
CCM (Instance de coordination nationale des subventions du Fonds mondial)	PTF	Coordonnateur Nationale des Subventions du Fonds Mondial
DGESS MENAPLN (Direction générale des études et des statistiques sectorielles Ministère de l'Education Nationale et de l'Alphabétisation et de la Promotion des Langues Nationales)	Education Nationale	Directeur générale des études sectorielles au ministère de l'éducation nationale et de l'alphabétisation et de la promotion des langues nationales
DGESS (Direction générale des études et des statistiques sectorielles) ministère de transport	Ministère de transport	Directeur général des études et des statistiques sectorielles du ministère de TRANSPORT
DIRECTEUR URBANISME (directeur de la formation des politiques et au niveau du ministère de l'urbanisme des affaires foncières et de l'habitat)	Ministère de l'urbanisme	Directeur de la formation des politiques et au niveau du ministère de l'urbanisme des affaires foncières et de l'habitat
DREA (Direction générale et de statistique sectoriel, du ministère de l'eau et de l'assainissement)	Ministère de l'eau	Directeur général et de statistique sectoriel, du ministère de l'eau et de l'assainissement
DPP, Ministère de l'économie et des Finances	Ministère de l'économie et des finances	Administrateur de base de données
AGRICULTURE	Ministère de l'agriculture	Agent responsable d'hygiène publique au ministère de l'agriculture
Direction générale des études et des statistiques sectorielles représentant Ministère de l'Environnement	Ministère de l'Environnement	Directeur générale des études et des statistiques sectorielles représentant Ministère de l'Environnement
TERRE DES HOMMES	ONG terre des hommes	Agent ONG terre des hommes

L'analyse des enquêtes réalisés auprès de ces secteurs don't la liste est indiquées dans le tableau ci-dessous sont en cours.

Objectif 2 – Définir les objectifs et termes de référence pour constituer un comité de coordination multisectoriel fonctionnel

Résultats – les termes de références du Comité multisectoriel pour la lutte contre le paludisme au Burkina Faso ont été écrits et communiqués au Ministère de la Santé.

Objectif 3 – Implémenter une activité conjointe avec la participation de plusieurs secteurs sanitaires et non sanitaires, et analyser les résultats et bénéfices de l'activité

Résultats – l'activité multisectorielle d'élimination des gîtes larvaires des moustiques vecteurs du paludisme a été déployée conjointement entre les secteurs de la santé, de l'aménagement des infrastructures (routes) de l'environnement et des communautés dans la ville de Manga entre les mois de Juillet et Septembre 2023. Les résultats des suivis entomologiques sur l'impact de l'activité sur les populations de vecteurs sont en cours d'analyse.

La participation des différents secteurs a été une réussite en termes de participation.

Training activities on multisectoral collaboration against vector-borne diseases

MULTISECTORAL APPROACH (MSA) MOOC

Module 1 of the MOOC available online in French and English: https://vbd-environment-mooc.org/. Modules 2 to 6 in development. MOOC will be released in the first half of 2024.

MSA training workshop, held in Saly, Senegal, 11–14 September 2023

A training workshop on MSAs for the prevention and control of VBDs took place from 11 to 14 September 2023 at Lamantin Beach hotel at Saly, Mbour, in Senegal. The following countries were represented: Burkina Faso, China, Côte d'Ivoire, France, Ghana, Mali, Niger, Portugal, Senegal, the United Republic of Tanzania, the United States and Zambia. On day one, the training was opened by the Coordinator of the National Malaria Control Programme (NMCP) of Senegal on behalf of the Ministry of Health and Social Action. After a round table to introduce participants, invited experts presented their scientific presentations.

On day two of the workshop, two working groups were formed (anglophone and francophone) to identify the impact that sectors, other than the health sector, have on the transmission of malaria in their respective countries. Discussion covered different sectors and their relationship with the health sector, as well as ways to improve collaboration.

A field visit to the health centre in the district of Popenguine (Mbour), also organized by the NMCP, took place on day three. The Chief Medical officer presented the malaria situation in the district, explaining that they had a reduction of malaria cases in 2023 due to good access to health facilities, the promotion of health services, and the provision of bednets. Participants visited the fishing dock of Ndayane where the president of the fishermen's association explained the reduction was due to awareness raising and increased use of LLINs at home. A woman called "Badjenou gokh", the representative of women of the area explained, they had implemented a "zero malaria, I'm committed" strategy, promoting the regular use of LLINs in all houses, as well as campaigns to raise awareness among women.

On day four, the two working groups reviewed those sectors having an impact on malaria transmission, acknowledging that some sectors, like Education, have only a positive impact. The working groups concluded with a proposal of activities to be implemented in each of the four countries of the United Nations Peace and Development Trust Fund project in collaboration with other sectors.

Remaining risks and challenges

No specific risks and challenges are remaining on this activity. The funds will be fully implemented, and the activities delivered as planned. This ER will close in December 2024, and the main findings will be used to transition to the ER 1.3.15.

Contributions towards TDR key performance indicators

Partnerships and collaborations: The partnership on this project included/includes: WHO–WASH; WHO–GMP; WHO–NTD; the IDRC, Canada; Swiss Development Cooperation and the Swiss Tropical and Public Health Institute (STPH); the Swedish International Development Agency (Sida); the National Institute of Parasitic Diseases (NIPD), China; and the UN Peace and Development Trust Fund. The partnerships also include several institutions in countries such as malaria control programmes, research institutes, WHO Country Offices and other national and regional partners.

Leverage created by this project: This ER remains funded essentially through designated funds which represent about 80% of the funding received for this ER. Designated funds also have different origins for different activities and collaborations. Sida is funding the activities under collaboration with WHO–WASH for a total budget of about US$ 700 000. The UN Peace and Development Funds is funding the activities under the collaboration with WHO–GMP for a total budget of US$ 390 000. The leverage created through the case studies within the countries are also estimated to represent about the same amount of the funds released for each project, for a total amount of US$ 700 000.

Gender aspects and vulnerable populations: For gender considerations, the following numbers are available in the research teams: for case study 1, one woman, four men; for case study 2, seven women, seven men; for case study 3, four women, one man, for case study 4, three women, two men, for case study 5, four men. The overall gender balance for all case studies in the countries is 44% of women involved. All case studies involved in the project are addressing specific issues for vulnerable and hard to reach populations. All projects will/do have benefits on the specific populations in many areas, in reduction of the transmission of diseases as already seen against arboviral diseases in Brazil and Ecuador, in reduction on malaria vector densities as already achieved in Mali, in access to better health services and water and sanitation, as implemented in Brazil. Each of the case studies will achieve direct benefits on the populations.

Training: The number of advanced degrees under way as a result of the case studies is not yet available. The number of people trained through short courses and training session was about 160 people for the virtual course held in 2021 and about the same number is expected for the MOOC. A lot of training materials is in development, including a MOOC on MSA. The training workshop in Senegal was attended by 30 participants.

Strengthened institutions and/or networks: Institutions and programmes involved in the case studies will be strengthened in their capacity to develop and implement multisectoral approaches. The number of institutions is different for each case study and varies, for a total number of about 20 institutions.

Publications: 9

Results dissemination and uptake: Through scientific publications from the case studies. Through the release of a Special Issue in an open peer-reviewed journal for the scientific communications delivered at the training workshop. Through information briefs, available for all seven countries involved in the case studies. Other communication materials (videos, pictures, animations) are currently in development.

Plans for 2024–2025

No plans for 2024–2025 since the ER is closing.

Strategic Development Fund

ACCESS TO BETTER VBD PREVENTION AND CONTROL FOR VULNERABLE AND HARD TO REACH POPULATION (ER 1.3.15)

Progress in 2023

Infectious diseases disproportionately affect the more deprived and vulnerable sections of society, including mobile and hard to reach populations. Addressing the needs of these populations is not just a matter of equity, or the effort to leave no one behind, but of epidemiological necessity as well. Within the new TDR Strategy 2024–2029, the second pillar focuses on the control and elimination of diseases of poverty in which TDR will support research that leads to integrated, holistic approaches to reduce and/or eliminate the burden of disease and build resilient health systems supporting better access to health for the most vulnerable populations.

MALAKIT PROJECT: Analysis of the brakes and levers for better use of anti-malarial treatments and adaptation of explanatory tools

Objectives of the proposal:

1. To better understand the gold miners awareness of drug resistance concepts.
2. To identify the best ways to transmit the information.
3. To adapt the appropriate training tools needed for community-health results.

Conclusion

This project has generated a better understanding of the knowledge and behavioural patterns of people working in informal gold mining sites in French Guiana. Community knowledge about malaria is quite extensive yet doubts and misconceptions remain. Moreover, behavioural patterns on the correct use of medicines do not correspond to an optimum level of knowledge about the disease. There are several barriers due to isolation, financial uncertainty, inaccessibility to health services, and lack of access to treatment for P. vivax hypnozoites. Project findings also show that the concept of emergence of anti-malarial resistant parasites is not understood, as well as the potential negative consequences of not completing treatment. In years when the most accessible drugs in French Guiana were those on the black market, taking only one part of the recommended treatment conferred several benefits: avoiding adverse effects, saving doses for possible relapses, sharing with others, and returning to a normal routine as soon as symptoms disappeared. These patterns of behaviour continue and are observable in the attitudes shared by study informants. However, those who obtained a Malakit and received training had more extensive knowledge and understanding regarding the importance of adherence to treatment. Throughout the study, collaboration continued with community health workers, individuals from the community, the partner group and design studios to reinforce messages for better malaria management.

Links:

Project: https://tdr.who.int/newsroom/news/item/05-10-2021-research-to-support-implementation-of-a-malaria-tool-for-remote-amazon-populations. Tools developed with TDR support: https://www.malakit-project.org/iec_tools/. Final workshop of the project: https://www.malakit-project.org/symposium-on-malaria-prevention-and-control-in-mobile-and-hard-to-reach-populations-paramaribo-april-6-8-2022/. On the 13 May 2022, a Malakit documentary received a special mention during an online awards ceremony organized by the WHO: https://www.malakit-project.org/malakit-film4health/. *(Final report available on demand)*

JOINT TDR AND STPH SYMPOSIUM ON MALARIA AND OTHER VECTOR-BORNE DISEASES IN MOBILE AND HARD TO REACH POPULATION

Contributions towards TDR key performance indicators

Partnerships and collaborations: The National Malaria Control Programme from Surinam; Centre d'Investigation Clinique Antilles-Guyane (INSERM), French Guiana; Fundação Oswaldo Cruz (FIOCRUZ), Brazil; Swiss Tropical Public Health Institute (STPH), Switzerland; International Center for Insect Physiology and Ecology, Kenya; and the Secretariat Elimination du Paludisme du Burkina Faso.

Leverage created by this project: Proposal submitted to Unitaid for US$ 3 million.

Gender aspects and vulnerable populations: Research project in Surinam, PI = one woman, Co-PI = one male; Symposium at ICTMM, presenters = two women and two men; Proposal submitted to Unitaid = Partners include four women and four men ; All projects are addressing vulnerable populations; Project in Surinam had direct benefits on the populations; Unitaid Proposal will have direct benefits on the populations.

Training: Through the project with Surinam: One PhD co-supported; several training materials developed; forty participants interviewed and trained in the use of the Kit. Other training activities planned within the ER 1.3.15 for 2024–2025.

Strengthened institutions and/or networks: National Malaria Control programme from Surinam strengthened through improvement of the use of the kit, allowing elimination of malaria in Surinam with no cases in 2022 and 2023. Further strengthening of institutions planned through the ER 1.3.15.

Publications: Special Issue with 7 articles under preparation

Results dissemination and uptake: Dissemination of the results from the SDF projects through a final workshop held in Surinam and a symposium at the International Congress for Tropical Medicine and Malaria (ICTMM) Conference; Uptake of Malakit by the National Malaria Control Programme from Surinam; Further results dissemination and uptake of results from ER 1.3.15.

Plans for 2024–2025

Within the context of an open Call for proposal from Unitaid on catalysing the adoption of an expanded vector control toolbox to fight malaria.[31]

TDR submitted a proposal entitled "*Operational research on new vector control tools to address the challenges of malaria transmission in mobile, migrant, and hard- to- reach populations*" in partnership with the International Centre of Insect Physiology and Ecology, Kenya and the Secretariat Permanent pour l'Elimination du Paludisme (SP-Palu) from Burkina Faso, for a three-year project with a budget of US$ 3 million. Based on feedback from the review process and the outcome of the selection, the activities will be deployed as per the proposal or revised accordingly.

Progress summary on previous expected results

None

[31] More details on the call for proposal is available at: https://unitaid.org/call-for-proposal/catalyzing-adoption-of-an-expanded-vector-control-toolbox-to-fight-malaria/#en.

Budget and financial implementation

Table 6. Approved Programme Budget 2022–2023 and funds utilized

Expected result	Research for Implementation	2022-2023								
		Revised planned costs September 2023			Implementation as at 31 December 2023			Implementation rates		
		UD	DF	Total	UD	DF	Total	UD	DF	Total
	Research for policy									
1.1.1	Country preparedness for disease outbreaks	250 000	45 000	295 000	191 722	45 000	236 722	77%	100%	80%
1.1.4	Country resilience to the threat of drug-resistant infections	250 000	2 030 000	2 280 000	229 547	1 939 393	2 168 941	92%	96%	95%
1.3.3	Vector-borne diseases and increasing resilience under climate change conditions	550 000		550 000	531 845	0	531 845	97%		97%
	Research for implementation									
1.1.7	Maximized utilization of data for public health decision-making	250 000	743 000	993 000	186 858	669 560	856 417	75%	90%	86%
1.1.8	Maximized utilization of safety information for public health decision-making	0		0	0	0	0			
1.2.1	Strategies to achieve and sustain disease elimination	825 000	5 000	830 000	778 922	2 500	781 422	94%	50%	94%
1.2.6	Optimized approaches for effective delivery and impact assessment of public health interventions	750 000	1 748 000	2 498 000	607 557	1 555 213	2 162 770	81%	89%	87%
1.3.12	Strategies to promote gender-responsive health interventions on prevention and control of infectious diseases of poverty	444 000		444 000	382 087	0	382 087	86%		86%
	Research for innovation	0			0	0				
1.1.5	Directions for development and accelerated access to new tools and strategies	185 000		185 000	97 978	0	97 978	53%		53%
1.3.10	Urban health interventions for vector-borne and other infectious diseases of poverty	150 000		150 000	149 803	0	149 803	100%		100%
1.3.14	Testing of innovative strategies for vector control	205 000	612 000	817 000	178 429	432 069	610 497	87%	71%	75%
	Research for integrated approaches	0			0	0				
1.3.11	Multisectoral approach for malaria and emerging arboviral diseases	400 000	649 000	1 049 000	193 821	532 245	726 066	48%	82%	69%
	Total	**4 259 000**	**5 832 000**	**10 091 000**	**3 528 568**	**5 175 980**	**8 704 549**	**83%**	**89%**	**86%**

Table 7. Approved Programme Budget 2024–2025

		2024-2025								
Expected result	Research for implementation	$40m scenario			$50m scenario			Revised planned costs at February 2024		
		UD	DF	Total	UD	DF	Total	UD	DF	Total
	Research for decision-making									
1.1.4	Country resilience to the threat of drug-resistant infections	300 000	200 000	500 000	500 000	700 000	1 200 000	300 000	200 000	500 000
1.1.7	Maximized utilization of data for public health decision-making	400 000	500 000	900 000	500 000	900 000	1 400 000	400 000	573 000	973 000
1.2.1	Strategies to achieve and sustain disease elimination	540 000	100 000	640 000	1 300 000	300 000	1 600 000	540 000	100 000	640 000
1.3.3	One Health approach for the control of vector-borne diseases in the context of climate change	400 000	500 000	900 000	600 000	600 000	1 200 000	400 000	500 000	900 000
	Research for delivery and access									
1.2.6	Optimized approaches for effective delivery and impact assessment of public health interventions	600 000	1 500 000	2 100 000	1 050 000	1 700 000	2 750 000	600 000	1 500 000	2 100 000
1.3.10	Urban health interventions for vector-borne and other infectious diseases of poverty	150 000	100 000	250 000	250 000	200 000	450 000	150 000	100 000	250 000
1.3.12	Strategies to promote gender-responsive health interventions	300 000	100 000	400 000	500 000	200 000	700 000	362 000	100 000	462 000
1.3.15	Vector-borne disease prevention and control for vulnerable and hard to reach populations	200 000	200 000	400 000	500 000	300 000	800 000	310 000	200 000	510 000
	Research for innovative solutions									
1.1.1	Country preparedness for disease outbreaks	150 000	500 000	650 000	200 000	500 000	700 000	150 000	500 000	650 000
1.1.5	Directions for development and accelerated access to new tools and strategies	160 000	0	160 000	300 000	0	300 000	160 000	0	160 000
1.3.14	Testing of innovative strategies for vector control	200 000	700 000	900 000	300 000	1 350 000	1 650 000	200 000	700 000	900 000
	Total	**3 400 000**	**4 400 000**	**7 800 000**	**6 000 000**	**6 750 000**	**12 750 000**	**3 572 000**	**4 473 000**	**8 045 000**

Projects and activities funded

Project ID	Principal investigator		Supplier name (Institution)	Project title	Funding in US$	Disease(s)	Research topic(s)	Countries involved
P22-00837	Phuong Nguyen	Thi Mai	Elsevier Besloten Vennootschap	Effectiveness and safety of Bedaquilline-based, Modified All-oral 9-11 month treatment regimen for rifampicin resistant Tuberculosis in Vietnam	4 278	Tuberculosis	Generic protocols; Implementation research; National programme capacity	Vietnam
P22-00874	Datvyan	Hayk	Tuberkulozi Hetazotutyunneri Yev Kankhargelman Kentron	Providing technical support for using the SORT IT platform during the implementation of SORT IT modules	6 600		Data management; Implementation research; Research for Policy; Research capacity strengthening Social innovation and research	Armenia
P23-00879	Harries	Anthony D.	Individual	Providing senior (second-line) operational research and subject matter expertise for the Structured Operational Research and Training Initiative (SORT IT) on tackling antimicrobial resistance in Low- and Middle-Income Countries.	12 000		Antimicrobial Resistance	United Kingdom
P23-00885	Yahouedo	Anankpo	Individual	The management of collaborative activities on multisectoral approaches (MSA) for the prevention and control of malaria within the activities.	31 500	Arboviral diseases	Multisectoral research	Benin
P23-00888	Ndiaye	Jean-Louis	Université de Thies	Organization of a regional meeting for RTS,S introduction in countries with High malaria seasonality	44 846	Malaria; Neglected Tropical Diseases; Tuberculosis	Drug safety; Implementation research; National programme capacity	Senegal
P23-00891	Riabinchuk	Mykhailo	Public Mission of Health (NGO)	Supporting the NTP in Ukraine to conduct activities for using digital technologies to support the TB response	10 640	Tuberculosis		Ukraine
P23-00892	Berger	Selma Dar	International Union Against Tuberculosis and Lung Disease	Providing senior technical expertise for assessing the impact of research studies from the Structured Operational Research Training Initiative (SORT IT) on tackling antimicrobial resistance in Ghana, Nepal and Sierra Leone (2023)	65 750		Antimicrobial Resistance	France

Project ID	Principal investigator		Supplier name (Institution)	Project title	Funding in US$	Disease(s)	Research topic(s)	Countries involved
P23-00893	DELAMOU	Alexandre	Centre National de Recherche et de Formation sur le Paludisme - CNRFP	Providing senior technical expertise for Assessing the impact of research studies from the Structured Operational Research Training Initiative (SORT IT) on tackling antimicrobial resistance in Ghana, Nepal and Sierra Leone (2023)	7 750		Antimicrobial Resistance	Guinea
P23-00894	Donckel	Debra	MEDECINS SANS FRONTEIRES LUXEMBOURG	Providing senior technical expertise for Assessing the impact of research studies from the Structured Operational Research Training Initiative (SORT IT) on tackling antimicrobial resistance in Ghana, Nepal and Sierra Leone (2023)	10 729		Antimicrobial Resistance	Luxembourg
P23-00895	Zolfo	Maria	Institute of Tropical Medicine	Providing senior technical expertise for Assessing the impact of research studies from the Structured Operational Research Training Initiative (SORT IT) on tackling antimicrobial resistance in Ghana, Nepal and Sierra Leone (2023)	7 675		Antimicrobial Resistance	Belgium
P23-00896	Shewade	Hemant	National Institute of Epidemiology - ICMR	Providing senior technical expertise for Assessing the impact of research studies from the Structured Operational Research Training Initiative (SORT IT) on tackling antimicrobial resistance in Ghana, Nepal and Sierra Leone (2023)	7 742		Antimicrobial Resistance	India
P23-00906	Soulaymani Bencheikh	Rachida	Rabat Collaborating Center	Organization of the Pharmacovigilance meeting for the members of the Programme of International Drug Monitoring in Africa, 2nd–3rd March 2023 Rabat, Morocco	23 765	Malaria; Neglected Tropical Diseases; Tuberculosis	Drug safety; Implementation research; National programme capacity	
P23-00907	Sinclair	Andrew	RPL 038 UNIVERSITAS MATARAM UNTUK DANA KELOLAAN BLU	Testing of Pyrolysis technology for Recycling Insecticide Treated Nets (ITNs)	5 831	Arboviral diseases	Multisectoral research	Indonesia
P23-00923	Tayler-Smith	Katherine	Individual	Literature search, categorization & archiving of peer-reviewed publications for supporting SORT IT module 3 of the specific studies on using operational research to accelerate progress towards ending TB/ MDR-TB in key populations in Kyrgyzstan	4 000		Data management; Implementation research; Research for Policy; Research capacity strengthening Social innovation and research	South Africa

Project ID	Principal investigator		Supplier name (Institution)	Project title	Funding in US$	Disease(s)	Research topic(s)	Countries involved
P23-00925	Berger	Selma Dar	International Union Against Tuberculosis and Lung Disease	Technical support for the implementation of a real time operational research project for assessing and managing disability, co-morbidities and risk factors associated with tuberculosis in Africa	28 500		Data management; Implementation research; Research for Policy; Research capacity strengthening Social innovation and research	France
P23-00928	Berger	Selma Dar	International Union Against Tuberculosis and Lung Disease	GES (Invoice No. 25000021) payment for EAG Approval for Africa Post	500		Antimicrobial Resistance	France
P23-00929	Wambugu	Martin	WARIDI PARADISE LIMITED	PROVIDING LOGISTICS SUPPORT FOR THE SORT IT WORKSHOP ON TB DISABILITY MODULES 1 & 2	11 560		Antimicrobial Resistance	Kenya
P23-00933	Soulaymani Bencheikh	Rachida	Rabat Collaborating Center	Support to ADP countries for participating to the 1st African PV conference	1 668	Malaria; Neglected Tropical Diseases; Tuberculosis	Drug safety; Implementation research; National programme capacity	Morocco
P23-00934	Sall	Fatimata	Individual	Country support for the conduct of the ShORRT research project.	24 000	Tuberculosis	Generic protocols; Implementation research; National programme capacity	Senegal
P23-00936	Archambaud	Benjamin	TE MOANA RESORT TAHITI	Accommodation for 35 participants for the on the Sterile Insect Technology (SIT) against Aedes vectors, to control Aedes-borne diseases Papeete, Tahiti, French Polynesia 2– 6 May 2023workshop	21 138	Arboviral diseases	Multisectoral research workshop	French Polynesia
P23-00937	Bossin	Herve	INSTITUT LOUIS MALARDE	Technical and logistics support for the planning/organization/implementation of TDR/WHO Training Workshop on Sterile Insect Technology (SIT) against Aedes vectors, to control Aedes-borne diseases Papeete, Tahiti, French Polynesia 2-6 May 2023.	13 530	Arboviral diseases	Multisectoral research; training	French Polynesia

Project ID	Principal investigator		Supplier name (Institution)	Project title	Funding in US$	Disease(s)	Research topic(s)	Countries involved
P23-00939	Hussain	Laith Naser	Individual	Technical assistance for the implementation of an "Effective, affordable and evidence-based dengue early warning and response systems"(EWARS for dengue control)	24 000	Arboviral diseases; Dengue	Disease outbreak	Brazil, Colombia, Dominican Republic, Ethiopia, India, Malaysia, Mexico, Mozambique, Sri Lanka and Thailand
P23-00943	Berger	Selma Dar	International Union Against Tuberculosis and Lung Disease	Development of data bases and quality assurance work: operational research project for managing disability, co-morbidities and risk factors associated with tuberculosis in Kenya, Uganda, Zambia and Zimbabwe	4 000	Tuberculosis	Data management; Implementation research; Research for Policy; Research capacity strengthening Social innovation and research	Kenya, Uganda, Zambia, Zimbabwe
P23-00945	Conan	Nolwenn	No affiliated institution	Addressing the yellow fever immunization gaps by improving its assessment in targeted countries.	63 000	Arboviral diseases	Generic protocol, implementation research	Cameroon, Guinea
P23-00948	Vaillant	Michel	Luxembourg Institute of Health	Supporting the data analysis of the ShORRT research package	13 000	Tuberculosis	Generic protocols; Implementation research; National programme capacity	
P23-00949	Lencho	Alemseged Abdissa	Armauer Hansen Research Institute - AHRI	Coordination and organization of the first meeting of NTPs in Southern and East Africa to establish a new regional research network	69 341	Tuberculosis	Network capacity for implementation research	Southern And Eastern African countries
P23-00951	Mekuria	Asrat	University of Gondar	Assessing programme capacities in visceral leishmaniasis-endemic countries in East Africa to implement WHO's treatment recommendations towards achieving universal health coverage and NTD roadmap targets	245 254	Visceral leishmaniasis	Disease elimination	Eritrea, South Sudan and Sudan

Project ID	Principal investigator		Supplier name (Institution)	Project title	Funding in US$	Disease(s)	Research topic(s)	Countries involved
P23-00954	Datvyan	Hayk	Tuberkulozi Hetazotutyunneri Yev Kankhargelman Kentron	Providing technical and software support for maintenance of the virtual SORT IT platform (e-SORT IT)	8 000		Data management; Implementation research; Research for Policy; Research capacity strengthening Social innovation and research	Armenia
P23-00956	Seck	Amadou	The GIE West and Centre	To provide support for data collection systems and analysis activities for TB-related research packages	24 200	Tuberculosis	Generic protocols; Implementation research; National programme capacity	
P23-00960	Rixson	Chris	Arctech Innovation	Development of The Terms of References for Centres of Reference in Medical Entomology Through the organization of a side-event at the 18th International Course on Dengue and other emerging Arboviruses. August 14-25, 2023 IPK, Havana, Cuba, in partnership	13 789	Malaria	Insecticide resistance	Cuba
P23-00964	Lencho	Alemseged Abdissa	Armauer Hansen Research Institute - AHRI	Support to the secretariat of the Southern and East Africa Regional Network for TB	14 000	Tuberculosis	Data management	Southern and Eastern African region
P23-00967	Shete	Priya	Individual	Development of a generic research protocol for evaluating the impact of social protection-related activities on TB patients and their families	24 500	Tuberculosis	Generic protocols; Implementation research	
P23-00968	Wutirat	Ratchanekorn	Inis Communication	Design and development of Spanish version of the Implementation Research for Digital technologies and TB toolkit website and offline, PDF versions in Spanish	7 831	Tuberculosis	Data management	
P23-00971	Goncharova	Olga	Individual	Providing technical support for field data collection of an operational research study entitled “Adherence Support strategies for anti-Tuberculosis Treatment during COVID-19 pandemic in Chui region, Kyrgyzstan, 2020-2021”	3 000		Data management; Implementation research; Research for Policy; Research capacity strengthening Social innovation and research	Kyrgyz Republic
P23-00972	Yahouedo	Anankpo Gildas	Individual	For the management of collaborative activities on multisectoral approaches (MSA) for the prevention and control of malaria.	40 619	Arboviral diseases	Multisectoral research	Benin

Project ID	Principal investigator		Supplier name (Institution)	Project title	Funding in US$	Disease(s)	Research topic(s)	Countries involved
P23-00974	Affolabi	Dissou	Programme National de Lutte contre la Tuberculose du Togo	Coordination of translation activities for the webinars and written documents	11 540	Tuberculosis	Generic protocols; Implementation research; National programme capacity	
P23-00975	Agbla	Schadrac	Individual	Support for conducting data analysis for ShORRT	2 700	Tuberculosis	Generic protocols; Implementation research; National programme capacity	
P23-00978	Dadzie	Samuel Kweku	Noguchi Memorial Institute for Medical Research	Capacity Building in Surveillance of Aedes mosquito vectors Arboviral diseases (Dengue, Zika and Chikungunya viruses and others) in the African region through the attendance to the 3rd meeting of the West African Aedes Surveillance Network (WAASuN) to be	8 616	Arboviral diseases; Vector-borne diseases	Research for Innovation	Cabo Verde; Ghana
P23-00980	KASWA KAYOMO	Michel	MINISTERE DE LA SANTE- PROGRAMME NATIONAL TUBERCULOSE (PNT) V/C	Supporting the National TB Programme to conduct in-country study monitoring for the finalization of the ShORRT project in DRC	23 708	Tuberculosis	Generic protocols; Implementation research; National programme capacity	DR of Congo
P23-00981	Camara	Alioune	Programme National de Lutte contre le Paludisme (PNLP)	Organization of a national dialogue meeting for RTS,S introduction in Guinea	80 267	Malaria	Implementation research; National programme capacity; Seasonal Malaria; Other	Guinea; Senegal; Togo
P23-00983	Gewehr	Sandra	EUROPEAN Mosquito Control Association (EMCA)	Development of a Best Practices document for mosquito control in build areas.	45 451	Vector-borne diseases	Research for Innovation; Sterile insect technique; Other	France; Greece; Spain
P23-00985	Bossin	Herve	INSTITUT LOUIS MALARDE	PAcific Islands Consortium for the Evaluation of Aedes SIT (PAC-SIT).	365 150	Arboviral diseases	Insecticide resistance	Chile; Cook Islands; French Polynesia
P23-00986	Berger	Selma Dar	The International Union Against Tuberculosis and Lung Diseases (The Union)	Providing senior technical expertise for a Structured Operational Research and Training IniTiative (SORT IT) for emergency preparedness and health systems strengthening to tackle Ebola and Emerging Infections in West and Central Africa	24 000	Ebola; Other		DR of Congo, Sierra Leone, Liberia, Guinea

Project ID	Principal investigator		Supplier name (Institution)	Project title	Funding in US$	Disease(s)	Research topic(s)	Countries involved
P23-00987	Papot	Emmanuelle	Individual	Consultancy HQ/SCI/TDR/IMP - 2304586 Implementation research on diseases of poverty in LMIC	64 852	Tuberculosis	Drug safety; Implementation research; National programme capacity	Ghana, Indonesia, India, Malawi, Senegal, Tanzania, Thailand, Nigeria, DR Congo
P23-00989	Pati	Sanghamitra	Indian Council of Medical Research (Bhubaneswar)	Survey activities to explore gender-dimensions of Water, Sanitation, and Hygiene, and Soil-Transmitted Helminth infection among urban poor children and pregnant women in Odisha, India	23 663	Soil-transmitted helminth infection	Community-based research; Gender; Urban health	India
P23-00990	Collins	Benjamin	The Global Health Impact Group	Evaluation of rapid diagnostics for Visceral Leishmaniasis (VL) control and elimination: planning and preparatory phase	68 000	Visceral leishmaniasis	Disease elimination; Diagnostics	Ethiopia and Kenya
P23-00995	Gueye	Salimata	Programme National de Lutte contre le Paludisme (PNLP)	Strengthening the capacity of surveillance and response in selected African countries to control malaria in different settings by China–Africa networking.	38 291	Arboviral diseases	Multisectoral research	Burkina Faso; Senegal; Tanzania; Zambia
P23-00996	Charoenviriyaphap	Theeraphap	Kasetsart University	To train scientists from Low and Middle Countries on data collection and sharing on vectors transmitting vector-borne diseases, to develop multisectoral approaches for the prevention and control of these diseases	36 287	Arboviral diseases; Malaria; Neglected Tropical Diseases; Vector-borne diseases	Data management	Brazil; Burkina Faso; Cameroon; Colombia; Côte d'Ivoire; Ghana; Indonesia; Malaysia; Sudan; Thailand
P23-01002	Lencho	Alemseged Abdissa	Armauer Hansen Research Institute - AHRI	Coordination and organization of a regional workshop on strengthening TB surveillance systems and identifying priorities for implementation research in Addis Ababa.	75 906	Tuberculosis	Data management	Eastern and Southern African countries
P23-01007	Chakaya	Jeremiah	Respiratory Society of Kenya	Financial management support for in-country expenses: operational research project for managing disability, co-morbidities and risk factors associated with tuberculosis in Kenya	15 275			
P23-01009	DUMCHEV	Kostyantyn	Individual	Technical support for data analysis and manuscript preparation to countries as part of the Implementation Research for Digital Technologies in TB (IR4DTB) project in WHO EURO region	10 000	Tuberculosis	Generic protocols; Implementation research	

Project ID	Principal investigator		Supplier name (Institution)	Project title	Funding in US$	Disease(s)	Research topic(s)	Countries involved
P23-01014	Berger	Selma Dar	International Union Against Tuberculosis and Lung Disease	Databases, metrics and archives on SORT IT activities and performance standards: courses, participants, facilitators, milestones, outcomes, publications, impact and other relevant materials.	13 800		Data management; Implementation research; Research for Policy; Research capacity strengthening Social innovation and research	France
P23-01015	Harries	Anthony D.	Individual	Providing senior (second-line) operational research and subject matter expertise for the Structured Operational Research and Training Initiative (SORT IT) on antimicrobial resistance and TB disability in Low- and Middle-Income Countries.	8 000	Tuberculosis	Antimicrobial Resistance	United Kingdom
P23-01021	Campbell	Jonathon	Individual	Provide technical support to country teams conducting economic evaluations within TB-focused implementation research activities.	13 950	Tuberculosis	Data management	
P23-01027	Dongo	John Paul	International Union Against Tuberculosis and Lung Disease	GES (Invoice No. 2023/003) payment for procuring glucometers and glucose strips for Assessing and managing disability, co-morbidities and risk factors after completing TB treatment: real time operational research in Uganda	382	Tubeerculosis	Data management; Implementation research; Research for Policy; Research capacity strengthening Social innovation and research	Uganda
P23-01028	Affolabi	Dissou	ONG WARN-TB	Coordination of WARN-TB and CARN-TB activities	25 107	Tuberculosis	Implementation research; National programme capacity; Networks	West and Central African countries
P23-01029	KASWA KAYOMO	Michel	Programme National de Lutte contre la Tuberculose (Kinshasa)	DRC – support for the conduct of the TDA4Child initiative in DRC	51 235	Tuberculosis		Congo, Dem. Rep.
P23-01030	Birhanu	Muluken	Assosa University	Support to NTP activities for using digital technologies to support the TB response in Ethiopia	10 022	Tuberculosis	Generic protocols; Implementation research	Ethiopia
P23-01031	Fall Dogo	Mohammed	Programme National de Lutte contre la Tuberculose du Togo	Support to NTP activities for using digital technologies to support the TB response in Togo	10 717	Tuberculosis	Generic protocols; Implementation research	Togo

Project ID	Principal investigator		Supplier name (Institution)	Project title	Funding in US$	Disease(s)	Research topic(s)	Countries involved
P23-01032	Lehyen	Darius	Individual	Field data collection and validation on healthcare workers hospitalized for COVID-19 in Liberia.	6 447	COVID-19	Implementation research	Liberia
P23-01035	N'diaye	Dieynaba Sophie	Individual	Support for strengthening the capacities of National Tuberculosis Programmes in health economics	1 250	Tuberculosis	Generic protocols; Implementation research	
P23-01037	Campbell	Scott	Individual	Development of Videos (including audio) at the Multi-Sectoral Approaches (MSA) on prevention and control of vector-borne diseases training workshop, held 11 to 14 September in Saly, Senegal	2 000	Arboviral diseases; Malaria	Multisectoral research	Burkina Faso; Senegal; Tanzania; Zambia
P23-01049	Joloba	Moses Lutaakome	Makerere University	Support to Makerere university for activities for using digital technologies to support the TB response in partnership with the Ugandan Supranational reference laboratory	10 000	Tuberculosis	Generic protocols; Implementation research	Uganda
P23-01050	Lencho	Alemseged Abdissa	Armauer Hansen Research Institute - AHRI	Supporting the Armaeur Hansen Research Institute (AHRI) as Secretariat of SEARN TB for activities to support the regional TB response in Southern and East Africa	11 000	Tuberculosis	Implementation research; National programme capacity; Networks; Research capacity strengthening Social innovation and research	Southern and Eastern African countries
P23-01051	Anyaike	Chukwuma	National Tuberculosis and Leprosy Control Programme	Nigeria – support for the conduct of the TDA4Child initiative dubbed as VEDUTA in Nigeria	60 946	Tuberculosis	Generic protocols; Implementation research	Nigeria
P23-01052	Tsehlo	Tsehlo	District Health Management Team, National TB Programme, Lesotho	Support to NTP activities for using digital technologies to support the TB response in Lesotho	11 055	Tuberculosis	Generic protocols; Implementation research	Lesotho
P23-01054	Lencho	Alemseged Abdissa	Armauer Hansen Research Institute - AHRI	Supporting the piloting of the TB Impact assessment DHIS module to evaluate the impact of COVID-19 pandemic on TB service provision in Ethiopia	9 300	Tuberculosis	Community-based research	Ethiopia
P23-01060	Turyahabwe	Stavia	National Tuberculosis and Leprosy Programme	Support to NTP activities for using digital technologies to support the TB response in Uganda.	10 073	Tuberculosis	Generic protocols; Implementation research	

Project ID	Principal investigator		Supplier name (Institution)	Project title	Funding in US$	Disease(s)	Research topic(s)	Countries involved
P23-01061	Shete	Priya	Individual	Collection of key stakeholder feedback and validation of a generic research protocol for evaluating the impact of social protection-related activities on TB patients and their families	7 500	Tuberculosis	generic protocol, implementation research	
P23-01062	Flacio	Eleonora	SCUOLA UNIVERSITARIA PROFESSIONALE DELLA SVIZZER A I TALIANA	Technical support for the Management of Special Issues in open peer review Journals to publish the outcomes of two TDR workshops.	20 157	Arboviral diseases	Multisectoral research; report/manuscript writing	Cook Islands; French Polynesia
P23-01099	N'diaye	Dieynaba Sophie	Individual	Supporting a scoping study of the social protection landscape for people affected by TB in DRC.	4 500	Tuberculosis	Implementation research, generic protocol	Democratic Republic of Congo
P23-01100	Kalasappa	Pruthu	Individual	Qualitative exploration on policy and/or practice changes (Impact) associated with completed operational research studies in Colombia, Ecuador and Ghana	5 200		Data management; Implementation research; Research for Policy; Research capacity strengthening Social innovation and research	India
P23-01108	Harries	Anthony D.	Individual	Providing senior (second line) operational research and subject matter expertise for the Structured Operational Research and Training Initiative (SORT IT) manuscripts translation quality on NTDs in Burkina Faso, Guinea, Mali, Niger and Senegal.	7 000		Data management; Implementation research; Research for Policy; Research capacity strengthening Social innovation and research	Burkina Faso; Guinea; Mali; Niger; Senegal
P23-01110	Affolabi	Dissou	ONG WARN-TB	Organization of the 2023 WARN-TB & CARN-TB meeting.	42 580	Tuberculosis	Implementation research; National programme capacity; Networks	West and Central African countries

Project ID	Principal investigator		Supplier name (Institution)	Project title	Funding in US$	Disease(s)	Research topic(s)	Countries involved
P23-01111	Niramitsantipong	Apinya	Ministry of Public Health	Coordination and Organization of the Regional Meeting on Arboviral Surveillance systems and the use of Early Outbreak Prediction Tools such as EWARS-csd in Countries of the Southeast Asia and West Pacific Regions	17 100	Arboviral diseases; Arboviruses; Chikungunya; Dengue; Rift valley fever; Zika virus	Disease outbreak; Implementation research; National programme capacity	Thailand
P23-01112	Akaniro	Obioma Chijioke	National Tuberculosis, Leprosy and Buruli ulcer Control Programme	Support to NTP activities for using digital technologies to support the TB response in Nigeria.	9 755	Tuberculosis	Generic protocols; Implementation research	Nigeria
P23-01113	Jose	Benedita	Ministerio da Saude	Support to NTP activities for using digital technologies to support the TB response in [COUNTRY]	10 884	Tuberculosis	Generic protocols; Implementation research; National programme capacity	Mozambique
P23-01119	Wambugu	Martin	WARIDI PARADISE LIMITED	PROVIDING LOGISTICS SUPPORT FOR THE SORT IT WORKSHOP ON TB DISABILITY MODULE 3	10 319		Data management; Implementation research; Research for Policy; Research capacity strengthening Social innovation and research	Kenya
P23-01122	Takashi Obara	Marcos	University of Brasilia	Zika, Dengue and Chikungunya: multisectoral approach for developing solutions applicable in public health by exploring the link between Poverty and Vector-Borne Diseases	63 000	Vector-borne diseases	Multisectoral research	Brazil
P23-01125	Salazaar	Miguel	Alliance for Improving Health Outcomes (AIHO)	Intersectionalities of gender, social disparities and antimicrobial resistance (AMR) in the Philippines: a scoping review and research gap analysis from a health policy and systems research perspective	44 802		Antimicrobial Resistance; Climate and environment; Gender	Philippines
P23-01126	CHARANI	ESMITA	University of Cape Town	Investigating the intersection gender and other sociocultural determinants of health and antimicrobial resistance in a changing climate: A mixed methods study in South Africa and India	44 901		Antimicrobial Resistance; Climate and environment; Gender	South Africa

Project ID	Principal investigator		Supplier name (Institution)	Project title	Funding in US$	Disease(s)	Research topic(s)	Countries involved
P23-01132	Krishnamoorthy	Yuvaraj	PROPUL Evidence	Intersecting Vulnerabilities: Investigating Gender, Antimicrobial Resistance, and Climate Change Influences on Infectious Disease Dynamics among Marginalized Populations in LMICs	45 326	Infectious diseases	Antimicrobial Resistance; Climate and environment; Gender	India
P23-01135	Churko	Chuchu	Arba Minch University	to support the NTD Programme outbreak response in generating critical data for targeted interventions.	21 000	Visceral leishmaniasis	Disease elimination	Ethiopia
P23-01136	Araujo	Vania	REDE BRASILEIRA DE PESQUISAS EM TUBERCULOLSE, REDE-TB	support for the evaluation of the performance of the WHO Global TB TDA for children.	10 000	Tuberculosis	Generic protocol, implementation research	
P23-01140	Seck	Amadou	The GIE West and Centre	To provide support for the development of data collection systems of TB research packages	26 800	Tuberculosis	Generic protocols; Implementation research	
P23-01141	Berger	Selma Dar	The International Union Against Tuberculosis and Lung Diseases (The Union)	Providing senior technical expertise for a Structured Operational Research and Training IniTiative (SORT IT) for tackling emerging infections and health systems strengthening in Egypt, Iran, Tunisia and the United Arab Emirates (EMRO region)	23 000		Data management; Implementation research; Research for Policy; Research capacity strengthening Social innovation and research	France
P23-01144	Datvyan	Hayk	Tuberkulozi Hetazotutyunneri Yev Kankhargelman Kentron	Upgrading the breakout-rooms of the virtual SORT platform for training (e-SORT IT).	2 500		Data management; Implementation research; Research for Policy; Research capacity strengthening Social innovation and research	Armenia
P23-01146	Affolabi	Dissou	ONG WARN-TB	Translation of evalution study material for Social protection in TB patients and generic research package for evaluating the impact of social protection support	2 000	Tuberculosis	Generic protocols; Implementation research	
P23-01150	Berger	Selma Dar	International Union Against Tuberculosis and Lung Disease	Independent review of ethics considerations for research studies for tackling emerging infections and health systems strengthening in Egypt, Iran, Tunisia and the United Arab Emirates (EMRO region)	6 000			

Project ID	Principal investigator		Supplier name (Institution)	Project title	Funding in US$	Disease(s)	Research topic(s)	Countries involved
P23-01153	Vaillant	Michel	Luxembourg Institute of Health	Finalising the statistical plan for ShoRRT and providing support to Pakistan	10 000	Tuberculosis	Generic protocols; Implementation research; National programme capacity; Research for Policy	Pakistan
P23-01155	Kazyoba	Paul	National Institute for Medical Research - NIMR	Support for baseline parasitological assessment of pediatric schistosomiasis in three district councils identified for pilot deployment of pediatric praziquantel in Tanzania	30 080	Neglected Tropical Diseases; Schistosomiasis	Drug safety; Implementation research; National programme capacity; Research for Policy	Tanzania
P23-01156	N'diaye	Dieynaba Sophie	Individual	Technical assistance for health economic study development and study analysis	14 500	Neglected Tropical Diseases; Schistosomiasis; Tuberculosis	Disease elimination; Implementation research; National programme capacity; Research for Policy	Tanzania
P23-01157	MAGASSOUBA	Aboubacar Sidiki	Programme national de Lutte Antituberculeuse - PNLAT	Support to NTP activities for using digital technologies to support the TB response in Guinea	10 985	Tuberculosis	Generic protocols; Implementation research	Guinea
P23-01158	Bekou	Wilfried	Individual	Support for the development of the 5 years strategic plan for the WARN-TB/CARN-TB.	18 000	Tuberculosis	Implementation research; National programme capacity; Networks	West and Central African countries
P23-01161	JOHNSON	JEREMIA MSHIU	National Institute for Medical Research - NIMR	Support to NTP activities for using digital technologies to support the TB response in Tanzania	9 479	Tuberculosis	Generic protocols; Implementation research	Tanzania
P23-01164	Lencho	Alemseged Abdissa	Armauer Hansen Research Institute - AHRI	To support the finalisation and communication of research findings among the SEARN-TB Regional network	24 000	Tuberculosis	Generic protocols; Implementation research	Southern and Eastern African countries
P23-01165	Affolabi	Dissou	ONG WARN-TB	To support the finalisation and communication of research findings among the WARN-TB & CARN-TB regional network	24 000	Tuberculosis	Generic protocols; Implementation research	West and Central African countries

Project ID	Principal investigator		Supplier name (Institution)	Project title	Funding in US$	Disease(s)	Research topic(s)	Countries involved
P23-01166	DUMCHEV	Kostyantyn	Individual	Technical support for coordination of a special issue on CAD4TB among six countries in WHO Euro region	10 000	Tuberculosis	generic protocol, implementationresearch	Eastern and Central Europe
P23-01167	Henneke	Philipp	University of Freiburg	Implementation of an early warning and response systems for dengue control (EWARS-csd)	10 274	Arboviral diseases	Disease outbreak	Brazil, Colombia, Dominican Republic, Ethiopia, India, Malaysia, Mexico, Mozambique, Sri Lanka and Thailand
P23-01168	Achar	Jay	Individual	support for the analysis and result dissemination in a scientific paper for a sub-study of ShORRT in countries of the WARN-TB/CARN-TB	12 500	Tuberculosis	Antimicrobial Resistance; Generic protocols; Implementation research; National programme capacity	West and Central Africa
P23-01169	Hussain	Laith Naser	Gothenburg University	Support for the publication of the paper entitled “Enabling countries to manage outbreaks: Statistical, operational, and contextual analysis of the early warning and response system (EWARS-csd) for dengue outbreaks”	3 300	Arboviral diseases	Toolkit	Brazil, Colombia, Dominican Republic, Ethiopia, India, Malaysia, Mexico, Mozambique, Sri Lanka and Thailand
P23-01182	Darboe	Muhammed Lamin	NATIONAL LEPROSY AND TUBERCULOSIS CONTROL PROGRAM	Support to NTP activities for using digital technologies to support the TB response in the Gambia.	9 443	Tuberculosis	Generic protocols; Implementation research	Gambia

TDR funding in 2023

Contributor	
Core contributors	**Amount (US$)**
Belgium	681 044
India	55 000
Japan	50 000
Luxembourg	1 185 037
Malaysia	25 000
Mexico	10 000
Nigeria (1)	200 000
Norway	306 341
Panama	7 000
Spain (2)	161 813
Sweden	1 162 487
Switzerland	1 940 639
Thailand	44 274
United Kingdom of Great Britain and Northern Ireland	3 877 001
World Health Organization	900 000
Miscellaneous	608
Subtotal	**10 606 244**
Contributors providing project-specific funding	**Amount (US$)**
International Development Research Centre	151 172
Luxembourg	413 340
Medicines Development for Global Health	8 495
Robert Koch Institute	272 065
Sweden (Sida)	313 418
United Kingdom Foreign, Commonwealth and Development Office	100 000
United Nations Development Programme	1 144 000
World Health Organization	487 986
Subtotal	**2 890 476**
Total contributions	13 496 720

1. The contribution from the Government of the Federal Republic of Nigeria for the period 2021 to 2023 was reported in full in the 2022 certified financial statement.
2. The contribution from the Government of Spain is for 2023 only. Contributions received in both 2022 and 2023 will be reported in the 2023 certified financial statement due to the timing of their receipt.

References

(Please see footnotes of the relevant page)

Scientific Working Group summary recommendations list

Recommendations	Remarks to the items raised
Continue effort in building bridges between the ERs, through a more strategic deliberate set of activities rather than through the current rather opportunistic ER manager led approach	*Discussions around the new Strategic Plan 2024–2029 have increased attention to maximizing opportunities of shared lessons and cross-fertilization of projects across ERs in the course of alignment of portfolio with the new Strategic Plan. The focus on global challenges provides a framework for building bridges across ERs strategically*
Further clarifying the balance of efforts between and within projects in those emphasizing "approaches, methods and tools" and those emphasizing "disease/issue-related objectives The SWG again emphasized the importance of building bridges between the ERs to maximise cross-cutting lessons learnt from a range of implementation research approaches being developed and tested	*IMP projects attempt to integrate a variety of "approaches, methods and tools" and "disease/issue specific objectives" in their projects as befits the context. The Strategic Plan emphasizes a One Health holistic, integrated approach as basis, and a focus on four main global health challenges to guide TDR implementation research. This allows for better harmonization of efforts and building towards broader disease-agnostic solutions.*
The IMP can and should role model sharing of learning and experiences across projects on the ground, where IMP can also foster South-South collaboration particularly with IMP networks	*An example is a series of webinars held on One Health bringing together several TDR-supported projects to share experiences; community engagement projects, national dialogue on malaria vaccines, MSA Senegal training workshop, VL meeting in E Africa, SORT IT studies (several), EWARS meeting in SEA, Malaria symposium*
That IMP conduct a mapping of implementation research approaches that IMP could further develop, optimise and apply to achieve its strategic goals	*There is rich experience with in particular the following approaches and tools for further optimisation and use in IMP work: One Health, Multisectoral approach, Gender intersectionality, Digital health, Generic toolkits, SORT IT approach, Network support (of national disease programmes), National dialogues (for evidence uptake and policy)*
A suggestion of future proportional contributions of IMP against poverty-related diseases, with an increased focus on NTDs encouraged, resources permitting	*Most of the current ERs address one or another NTD. IMP will continue to prioritize infectious disease challenges of neglected populations.* *Among the 11 ERs, three of which are dedicated exclusively to NTDs and eight address NTD challenges to a variable extent.*

Recommendations	Remarks to the items raised
A visualisation of the pipeline through which IMP will enable novel interventions being successfully integrated into health services	*Pipeline of novel interventions being compiled*
A suggested focus of TDR IMP on building resilience against three major threats (Resistance, Pandemics and Climate change) in LMIC health research systems, particularly in under-served communities	*This focus is emphasized in the new Strategic Plan*

Annex 1. Publications list

1.1.1 Country preparedness for disease outbreaks

1. Sanchez Tejeda G et al. Early warning and response system for dengue outbreaks: Moving from research to operational implementation in Mexico. PLOS Glob Public Health. 2023 Sep 20;3(9). doi.org/10.1371/journal.pgph.0001691.
2. TDR and Global Health Hub. Innovation and Collaboration: the EWARS Framework for infectious diseases. 2022. https://www.gu.se/sites/default/files/2022-03/GHHG_PolicyBrief_EWARS-2022.pdf.
3. TDR. Surveillance and control of arboviral diseases in the WHO African Region: assessment of country capacities. 2022. https://tdr.who.int/publications/i/item/9789240052918.
4. WHO News release, 11 December 2021. Assessing African country capacities to prevent, detect and respond to arboviral disease outbreaks.

1.1.4 Country resilience to the threat of drug-resistant infections

Special issues

5. Impact of Operational Research in Tackling Antimicrobial Resistance through the Structured Operational Research Training Initiative in Ghana, Nepal and Sierra Leone". Tropical Medicine and Infectious Diseases, https://www.mdpi.com/journal/tropicalmed/special_issues/7F8T7R680I.
6. "Operational research to tackle antimicrobial resistance". Pan-American Health Journal of Public Health, https://www.paho.org/journal/en/special-issues/operational-research-tackle-antimicrobial-resistance.
7. "Operational Research to Tackle Antimicrobial Resistance in Ghana". IJERPH | Special Issue: Operational Research to Tackle Antimicrobial Resistance in Ghana (mdpi.com).
8. "Operational Research and Capacity Building to Tackle Antimicrobial Resistance in Sierra Leone. Operational Research and Capacity Building to Tackle Antimicrobial Resistance in Sierra Leone (mdpi.com).
9. "Operational research to tackle AMR in Nepal". Public Health Action, Public Health Action: Ingenta Connect Table Of Contents Public Health Action: Ingenta Connect Table Of Contents.
10. "AMR in Low-and-Middle-Income Countries". Tropical Medicine and Infectious Diseases, https://www.mdpi.com/journal/tropicalmed/special_issues/AMR.

Editorials

11. Celis Y, Esparza G, Zachariah R, Pérez F. Operational research to strengthen evidence-based interventions to tackle antimicrobial resistance in the Region of the Americas. Revista Panamericana de Salud Pública. 2023;47:e78.

Impact Assessment of previous SORT IT publications on AMR

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14. Kpagoi SSTK, Kamara KN, Carshon-Marsh R, Delamou A, Manzi M, Kamara RZ, Moiwo MM, Kamara M, Koroma Z, Lakoh S, et al. Assessing Changes in Surgical Site Infections and Antibiotic Use among Caesarean Section and Herniorrhaphy Patients at a Regional Hospital in Sierra Leone Following Operational Research in 2021. Tropical Medicine and Infectious Disease. 2023; 8(8):385.
15. Upadhaya S, Acharya J, Zolfo M, Nair D, Kharel M, Shrestha A, Shrestha B, Madhup SK, Raghubanshi BR, Kattel HP, et al. Has Data Quality of an Antimicrobial Resistance Surveillance System in a Province of Nepal Improved between 2019 and 2022? Tropical Medicine and Infectious Disease. 2023; 8(8):399.
16. Konteh SA, Bangura FI, Leno A, Satyanarayana S, Nair D, Bah MA, Saidu S, Sellu-Sallu D, Gborie SR, Kamara SM, et al. Improvement in the Surveillance System for Livestock Diseases and Antimicrobial Use Following Operational Research Studies in Sierra Leone January–March 2023. Tropical Medicine and Infectious Disease. 2023; 8(8):408.
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18. Moiwo MM, Kamara GN, Kamara D, Kamara IF, Sevalie S, Koroma Z, Kamara KN, Kamara MN, Kamara RZ, Kpagoi SSTK, et al. Have Hand Hygiene Practices in Two Tertiary Care Hospitals, Freetown, Sierra Leone, Improved in 2023 following Operational Research in 2021? Tropical Medicine and Infectious Disease. 2023; 8(9):431.
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20. Squire SS et al. Gaps in Infection Prevention and Control in Public Health Facilities of Sierra Leone after the 2014–2015 Ebola Outbreak, Trop. Med. Infect. Dis. 2021, 6(2), 89.

Tackling AMR- Columbia/Ecuador/Ghana

21. Calero-Cáceres W, Rodríguez K, Medina A, Medina J, Ortuño-Gutiérrez N, Sunyoto T, Dias CAG, Bastidas-Caldes C, Ramírez MS, Harries AD. Genomic insights of mcr-1 harboring Escherichia coli by geographical region and a One-Health perspective. Frontiers in Microbiology. 2023 Jan 16;13:5474.
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33. Boakye-Yiadom E, Najjemba R, Thekkur P, Labi A-K, Gil-Cuesta J, Asafo-Adjei K, Mensah P, van Boetzelaer E, Jessani NS, Orish VN. Use and Quality of Blood Cultures for the Diagnosis of Bloodstream Infections: A Cross-Sectional Study in the Ho Teaching Hospital, Ghana, 2019–2021. International Journal of Environmental Research and Public Health. 2023; 20(17):6631.

ER 1.1.7 List of publications in 2023 (for AMR publications, please see ER 1.1.4)

Updated SORT IT website publications on operational research and training

Special journal issue on tackling TB/MDR-TB in hard-to-reach populations

34. Diro C and SG Hinderaker, TMIDJ Special Issue: “Accelerating Progress towards Ending TB/MDR-TB and Strengthening the Operational Research Capacity of the National Tuberculosis Control Program in Kyrgyzstan". Trop. Med. Infect. Dis. 2023, 8(6), 316 https://www.mdpi.com/si/171812.

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Tackling TB/MDR-TB in hard-to-reach populations

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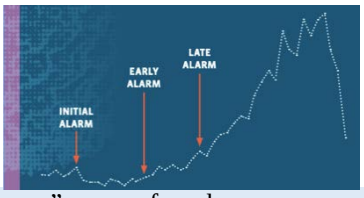
Supplementary files

ER 1.1.1 Country preparedness for disease outbreaks

EWARS

(Early Warning and Response System) for climate sensitive diseases



Scope of work	EWARS falls into the "Country preparedness and outbreak response" scope of work. It was designed to predict effectively and in a user friendly manner epidemics of climate-sensitive diseases such as dengue, chikungunya, Zika, cholera, malaria, among others. EWARS' conceptualization was based on the biological relationship between the change in a weather condition and the manifestation of a disease outbreak in a specific geographic area/population. EWARS is therefore perceived not only as a statistical but also as an information system designed to support decision-making for national and local level health institutions, enabling them to take action to mitigate the impact of an impending outbreak.
Aim	This predicting tool aims at: (i) strengthening surveillance systems for climate sensitive diseases; and ii) triggering early vector control by strengthening the coordination between all relevant stakeholders, such as local epidemiologists, meteorologists, entomologists, national and local management agencies that assess risk and develop response strategies, and the public communication channels used to disseminate warning information.
Why is it needed?	Climate sensitive infectious diseases are currently the fastest spreading illnesses in the world, with over half of the world's population living in areas at risk of dengue, as one of many examples. With climate change, such diseases continue to spread and become a health burden for more communities. It is essential to have tools that can predict when and where outbreaks might occur, to better prepare communities and control programmes. Usually a country's national vector control programme is guided by reported cases, which are often under-estimated. EWARS works upstream by predicting in advance outbreak scenarios based on alarm predictors such as meteorological, epidemiological and entomological data, which can guide an early structured response in time and space, prior to the disease manifestation.
Functions	EWARS builds a prediction algorithm that is data and area specific, using historical disease records, and analyses retrospectively their association with alarm indicators (which are the functions of dashboard 1 used at the country or central level). It further employs prospective (weekly) alarm information, e.g., mean temperature, humidity, rainfall, ovitrap index, among others, to predict a forthcoming outbreak (which is a function of dashboard 2 used at district level). EWARS uses a robust modelling system with a user-friendly interface to enable data understanding by frontline health care workers and data use for appropriate local response. It has the potential to improve collaboration at regional level (i.e., regional surveillance, data sourcing, joint response, etc.) for surveillance and response, applying a multisectoral approach.
Designed by	EWARS employed a co-design and co-production approach led by the UNICEF/UNDP/World Bank/ WHO Special Programme for Research and Training in Tropical Diseases (TDR) and the World Health Organization's Climate Change and Health Unit, together with endemic countries, the University of Freiburg (Germany) and the University of Gothenburg (Sweden), and engaging key stakeholders such as the World Meteorological Organization, IT experts, endemic partner countries (ministries of health, district health managers, local meteorological and entomological entities) in five WHO regions. Its development benefited from users' feedback, including recommendations for improvements.

Launched	EWARS has been developed, used, and validated since 2012 in more than 17 countries in the WHO Regions of Africa, the Americas, the Eastern Mediterranean, South-East Asia and the Western Pacific, and is close to being fully implemented in the national surveillance platforms of Colombia, the Dominican Republic, Mexico and Thailand.
Access	EWARS is a free open-access tool, based on free R software, created with the aim of granting countries full ownership of the tool and its processes.
Target users	Country ministries of health and district health managers.
Countries	All tropical and sub-tropical countries prone to climate sensitive diseases. EWARS is currently being used in five of the six WHO regions (see above).
Languages	A generic English version is offered, but typically once installed in the country's local server, local language can be used. For instance, the Dominican Republic and Mexico have the tool in Spanish and Thailand in Thai.
Technical features	Essentially, EWARS is designed in such a way that it can integrate within countries' routine activities, i.e., not to add more work or effort on already overstretched national control programmes. It facilitates a user-friendly interface (only minimal calibration or application needed) and can be hosted by any local server so that ministry of health and districts/ municipalities are digitally connected for information exchange and monitoring.
Interoperability	It is designed in a flexible way so that countries can monitor alarm signals at the central and local level. Commonly, the ministry of health or the national institute of health is the central level overseeing the process, but the district level is usually the first to take action, in agreement with the central level. Larger countries such as India could see states acting as central levels to align with the large number of districts and localities. Interoperability with the surveillance system DHIS2 has also been achieved.
Outreach	The WHO/Climate Change and Health Unit (CCH) and TDR are overseeing the administrative process, while the partner universities (Freiburg and Gothenburg) maintain the technical and operational aspects, as well as providing expertise on surveillance, training, and response. TDR supports implementation research for evaluating the feasibility, acceptability and impact of using EWARS and WHO/CCH is helping with access to meteorological data.
Security and privacy	The tool is 100% owned by users and uploaded on local servers, so countries take control of their data, ensuring security and privacy. The tool is further designed to allow secured access and communication within and between districts, i.e., ministries of health have the administrative power to assign users and passwords.
Core features	**Data management and reporting** • EWARS works as a subset of the national surveillance programme. • While it requires simple time and area specific information (in Excel format), it can also act as a data hub/storage of prospective information. • It organizes the data feeding in an automated way, automatically connecting, and feeding data between the surveillance programme and meteorological or entomological entities, which saves time and effort and improves consistency of data. **Availability and support** • The tool has a series of published reports (available on WHO's website), video training (on YouTube and the EWARS GitHub) and pre-recorded PowerPoint presentations to guide users in the installation, calibration, and interpretation of the tool's parameters. • The EWARS team provides monthly follow-up and technical assistance. **Customization and flexibility** • The tool relies on the country's local (often already existing) server. • Country IT personnel are engaged to understand the tool's features and to take part in the installation process. • The tool is designed in such a way that additional or independent maintenance is not required as it aligns with the routine IT tasks of the country's server.

- **Security and compliance**
  - Data are located in and owned by the country. Therefore, data security follows the country's own protocol. The tool provides a means for increasing the security aspects for users, but it is entirely up to users how they control that.
- **User management**
  - There is no limitation to the number of users, depending on the server's capacity. However, by virtue of the automated feature of data feeding, the central level (ministry of health) will do the semi-automatic calibration only once per year, otherwise, no specific management activities are needed.

ER 1.1.4 Country resilience to the threat of drug-resistant infections

Annexes 1a-1d: Success stories of impact from Ghana, Nepal and Sierra Leone

2.a. Success story - Nepal

Research evidence put into practice improves antibiotic use during surgery in Dhulikhel Hospital, Nepal

Study title: Indira Shrestha et al. Surgical Antibiotic Prophylaxis Administration Improved after introducing dedicated guidelines: A before-and-after study from Dhulikhel Hospital in Nepal (2019–2023), *Tropical Medicine and Infectious Disease*, 2023 (Under peer review)

What did research show?

Thirty to fifty percent of all antibiotics in hospitals is used to prevent infections during surgery. This is known as Surgical Antibiotic Prophylaxis (SAP). Such antibiotic use minimizes the risk of infection occurring at incision sites. Except for those with clean wounds, all individuals who undergo surgery should receive a first dose of SAP, and if surgery lasts for more than two hours then a second dose of antibiotic is given. Good compliance to SAP guidelines is important to reduce the risk of surgical infections and the development of antibiotic resistance.

In 2021, a study by Sulekha Shrestha et al,[1] working at the Dhulikhel hospital in Nepal, showed that overall compliance to national SAP guidelines was 75% and needed to be improved. Of note, 50% of those with clean wounds and not eligible to receive antibiotics received them unnecessarily, and 14% of those needing a repeat dose due to prolonged surgery did not receive it.

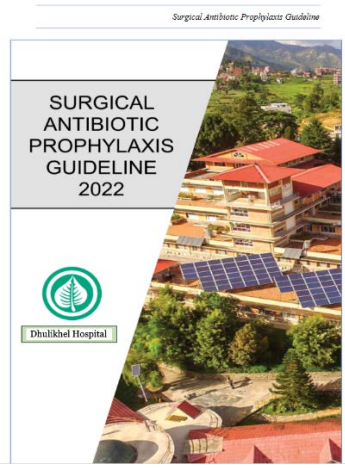
What actions were taken?

The findings were communicated to the hospital management team and the following decisions and actions were taken.

Decision taken	Action status (June 2023)

[1] Shrestha S, Hann K, Kyaw K. W. Y, Koju P, K.M. Surgical Antibiotic Prophylaxis Administration Practices. Public Heal. Action 2021, 11, 18–23 https://www.ingentaconnect.com/content/iuatld/pha/2021/

Establish a hospital committee for rational antibiotic use	Implemented
Develop a dedicated hospital SAP guideline	Implemented
Train surgeons, anaesthetists and nurses	Implemented
Establish a hospital antibiotic stewardship programme	Ongoing



Pictures (left to right): Hospital SAP guideline; Dhulikhel hospital team

Pictures: Meeting with a surgical team at Dhulikhel hospital

What was the impact on policy and/or practice?

To assess impact, Indira Shrestha et al. conducted a follow-up study (January–April 2023) and compared the results with the initial study, which revealed the following:

- A total of 874 patients were included in the initial study and 751 in the follow-up study.
- Overall SAP compliance increased from 75–85%.
- Unnecessary antibiotic use for those with clean wounds and not eligible for a first dose reduced from 50–38%.

- Antibiotic use for those eligible for a repeat dose due to prolonged surgery increased from 14–22%.

Conclusion

Although there is room for improvement, introduction of a hospital SAP guideline was associated with improved antibiotic use. This study highlights the role of operational research in triggering favorable practices in hospital clinical care.

2.b. Success story- Sierra Leone

Improvement in infection prevention and control following operational research in Sierra Leone

Study title: Senesie Margao et al. Improvement in infection prevention and control performance following operational research in Sierra Leone: A *before* (2021) and after (2023). *Tropical Medicine and Infectious Disease*, 2023 (Under peer review)

What did research show?

Infection prevention and control (IPC) measures at health facilities are a central pillar for protecting patients, visitors and health workers from acquiring healthcare-associated infections. Good IPC standards are vital to tackle antimicrobial resistance (AMR), the logic being "one prevented infection is one antibiotic treatment avoided".

In 2021, an initial study by Bobson Fofanah et al.,[2] working at the national IPC programme unit within the Ministry of Health and Sanitation of Sierra Leone, showed that IPC performance was at 'intermediate' level (58%) in the national IPC programme unit and at 'basic' level (50%) at all 12 district-level hospitals.

What actions were taken?

The findings were communicated to decision-makers involved in implementing the IPC programme in the country and the following decisions and actions were taken.

Decision taken	Action status (June 2023)
Advocate for a dedicated budget for IPC activities	Implemented
Distribution of national IPC guidelines to health facilities	Implemented
Dedicated time to be allocated to IPC staff at health facilities to adapt and implement IPC guidelines. Train surgeons, anaesthetists and nurses	Implemented
Clear goals, targets and activities introduced in the monitoring framework for health facilities	Implemented
Uninterrupted supplies of consumables such as soap, alcohol-based hand rub and personal protective equipment	Ongoing
Formulating a surveillance strategy for health care infections	Ongoing

[22] Derrick Fofanah B. A. Abrahamyan A, Maruta, A. et al. Achieving Minimum Standards for Infection Prevention and Control in Sierra Leone: Urgent Need for a Quantum Leap in Progress in the COVID-19 Era! *International Journal of Environmental Research and Public Health* 2022, 19, 5642, https://www.mdpi.com/1660-4601/19/9/5642

Pictures (left to right) Field supervision, data validation and mentorship of trainees involved with infection prevention and control at a Government hospital in Sierra Leone; alcohol hand-rub solution produced locally in Sierra Leone for distribution to health facilities.

What was the impact on policy and/or practice?

To assess impact of these measures, Senesie Margao et al. conducted a follow-up study (January to April 2023) and compared the findings with the initial study:

- Overall IPC performance in the national IPC programme unit shifted from intermediate (58%) to advanced (78%), with improvements in all six IPC core components. Four out of six components achieved advanced level compared to one in 2021.
- The median performance score for hospitals moved from basic (50%) to intermediate (59%), with improvements in six of eight IPC core components. Three of the four gaps identified in 2021 at the national IPC programme unit and four of the seven gaps at hospitals had been addressed by 2023.

Conclusions

This study highlights the importance of embedding operational research as part of routine IPC monitoring and its contribution to informed decision-making in a continuum.

2.c. Success story - Country Capacity

Those trained through SORT IT are now leading new research capacity building projects in Sierra Leone

SORT IT, the Structured Operational Research and Training IniTiative

A novel research capacity building project

Sustainable Health Systems Sierra Leone (a nongovernmental organization), in collaboration with the Ministry of Health and with funding from the University of Toronto, is implementing a novel research capacity building project entitled **"Testing resilience: An evaluation of the health systems impact of COVID-19 in post-Ebola Sierra Leone."**

The project has been designed following the SORT IT model and has been adapted locally. Read more on SORT IT here: https://tdr.who.int/activities/sort-it-operational-research-and-training.

Project leadership demonstrated

Of significance is the project leadership, a testament to the strength and efficacy of the SORT IT model and its legacy of empowering future leaders in health research. The project's lead in Sierra Leone is a former SORT IT mentee, showcasing the full-circle transformation from mentee to mentor and leader.

Further enriching the mentorship pool, four of the nine mentors assigned to this project, with nine policy-relevant research projects, are alumni of previous SORT IT trainings. These mentors bring their own experiences from their journey as mentees, serving as a source of inspiration, relatability and knowledge of the challenges and successes mentees might experience.

To promote sustainability, there are ongoing efforts by the Ministry of Health and Sanitation to integrate SORT IT within the curriculum of the University of Sierra Leone.

Longer term impact

This project aims to significantly strengthen the research capacity in Sierra Leone, especially in evaluating and mitigating health system impacts of major outbreaks such as Ebola and COVID-19. By doing so, the project will contribute to enhancing the resilience of Sierra Leone's health system and its capacity to respond effectively to future health crises.

"SORT IT has developed a pool of trained researchers including frontline health workers, program managers and decision-makers who became leaders in training others to find effective solutions to local challenges and build health system resilience". Dr Suleiman Lokoh, Lead of the National SORT IT initiative, Sierra Leone

Pictures (left to right): Group photo of trainees and mentors; a trainee working on a research protocol

Examples of research topics

Partners	Research topics
Tuberculosis programme	A 10-year evaluation of national TB case notification: An evaluation of the impact of Ebola and COVID-19
Malaria programme	The impact of the COVID-19 pandemic on uptake and implementation of malaria prevention and control in antenatal care
Partners in Health	The effect of the COVID-19 pandemic on maternal health services utilization and outcomes
34 Military Hospital	The impact of the COVID-19 pandemic on uptake of HIV testing
Nutrition programme	Nutritional indicators of health service delivery for children aged under 5 years. Pre-, intra- and post-Ebola and COVID-19 periods
Reproductive health	Uptake of contraceptive methods among women and girls aged 10–45 years in relation to Ebola and COVID-19
National AIDS Programme	The impact of the COVID-19 pandemic on antiretroviral treatment
National Emergency Services	The impact of the COVID-19 pandemic on maternal and paediatric referrals and hospital bed occupancy

2.d. Success story - Ghana

Improved data quality on antibiotic use in a rural veterinary clinic following operational research in Ghana

Study title: Cletus Kubasari et al. Quality of data recording and antimicrobial use in a rural veterinary clinic in Ghana following an operational research conducted in July 2021, *Tropical Medicine and Infectious Disease*. 2023 (Under peer review)

What did research show?

Correct recording of diagnosis and antibiotic use in veterinary clinics is important for informing Ghana's 'One Health' approach on evaluating prescribing practices and improving antibiotic stewardship for tackling antimicrobial resistance. Since 70% of all antibiotics consumed globally are used in animals, this subject is of major public health importance.

In 2021, an operational research study by Wisdom Adeapena et al[3], working at the Kintampo veterinary clinic, showed incomplete documentation on the diagnosis and treatment of animals making it difficult to monitor antimicrobial use. Of 513 animals treated in the clinic, 54% had no disease diagnosis indicated and in 53% the type of antibiotic prescribed was not specified[1].

What actions were taken?

The findings were communicated to the national stakeholders and the following decisions and actions were taken to improve data quality.

Decisions taken	Action status (June 2023)
Sensitize national stakeholders and veterinary staff on the importance of good documentation/recording of antibiotic use in animals	Ongoing
Veterinary Service Directorate to develop standard treatment guidelines for antimicrobial use in animals	Partially implemented and ongoing
Introduce country-wide electronic data collection system	Ongoing

[3] Adeapena W, Afari-Asiedu S, Najjemba R, Griensven Jv, Delamou A, Ohene Buabeng K, et al. Antibiotic use in a municipal veterinary clinic in Ghana. Tropical Medicine and Infectious Disease. 2021;6(3):138. https://www.mdpi.com/1195606

Pictures (left to right): A dog receiving care; review of the veterinary records

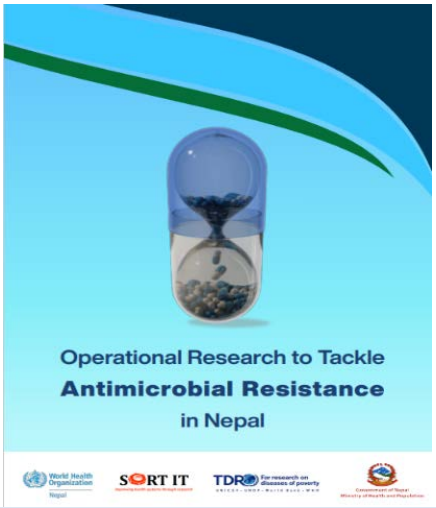
What was the impact on policy and/or practice?

To assess impact at the Kintampo veterinary clinic, Cletus Kubasari et al. conducted a follow-up study (January to April 2023) which showed the following.

- A total of 513 records of animals were included in the initial study and 219 animals in the follow-up study.
- Recording of the diagnosis of animal diseases improved from 47% to 90%.
- Recording of the type of antibiotics prescribed improved from 53% to 77%.
- However, routes of drug administration and antibiotic dosages were not being recorded.

Conclusion

Although improvements are being made, more needs to be done. Additional recommendations from the second study are: a) introduce a standard electronic treatment register for monitoring veterinary drug prescription practices; b) conduct refresher trainings on prescription practices, emphasizing the need for documenting routes of drug administration and antibiotic dosages; and c) introduce regular supervision by the regional and national veterinary bodies.



"SORT IT has made significant contributions to the national AMR effort by developing operational research capacity and publishing high-quality research that was effectively communicated to various stake holders. This has improved collaborative action to tackle AMR in the country."

Dr Rajesh Pandav Sambhajirao, WHO Representative, Nepal

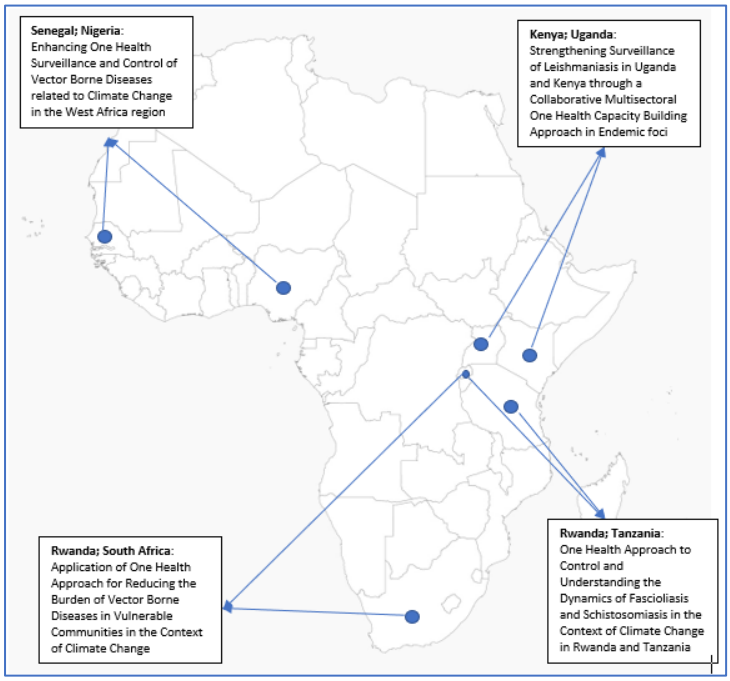
Pictures (left to right)**:** Plain language summaries; Plenary session involving 22 institutions working together on research projects (Ghana, Nepal, Sierra Leone); A presentation being reviewed in a plenary session (Sierra Leone)

"The SORT IT training on research communication is vital to present research findings in a simple manner. It allows decision-makers to easily grasp the key messages and take action to improve public health."

Dr Mohammed Vandi, Director of AMR and health emergences, Sierra Leone

ER 1.3.3 Vector-borne diseases and increasing resilience under climate change conditions

Progress of projects:



Fourteen projects were received and reviewed by a panel composed by external experts and TDR team.

In November 2022, four research proposals were selected and initiated to address One Health implementation research priorities for Vector borne diseases (VBDs) in the context of climate change in Africa.

Project 1: Strengthening surveillance of leishmaniasis in Uganda and Kenya through a collaborative multisectoral One Health capacity building approach in endemic foci (Uganda and Kenya)

This study is conducted by the Makerere University, the University of Nairobi, Africa One Health University Network (AFROHUN) Uganda and the Kenya Medical Research Institute (KEMRI). This study aims **to identify leishmaniasis hotspots and decipher the risks and climate factors associated with the disease within endemic foci** using retrospective passive and active screening data in humans and animals, as well as climate data.

Progress:

- A joint protocol was developed between Uganda and Kenya. Local ethical approval has been attained for both countries in May 2023. WHO ERC had approved the protocol, however a few amended ICFs were requested which have been submitted. Final ethical approval from WHO ERC is expected within the September 2023.
- The team has had regular meeting internally as well as with TDR to discuss the work plan, progress and prepare for implementation phase/activities.
- A curriculum was created for a One Health course on Leishmaniasis by Makerere University, College of Veterinary Medicine, Animal Resources and Biosecurity and Centre for Biosecurity and Global Health. Frontline workers were concurrently trained.

- The seminar at Makerere University was conducted to introduce biotechnology students and vector biologists to the One Health approach for leishmaniasis control and management.
- Trained frontline workers under the supervision of the project team collected Animal data through screening of 252 dogs for leishmaniasis, from Karamoja region, Uganda, a region from where no animal data has been obtained in the past. Trainings were conducted on leishmaniasis diagnostics. Trainings were also conducted for vector sampling (sandfly trapping).
- Analogous leishmaniasis data from the year 2009-2020 is being digitalised. Retrospective climate data is also being analysed.
    - Sample collection from human subjects will be taken from kala-azar treatment centres, Amudat hospital and Moroto Regional Referral Hospital in the last quarter of 2023, through an active screening processing carried out routinely by the Ministry of Health and those diagnosed at routine check-ups.
    - ELISA and PCR will be used to detect leishmaniasis in all human and dog samples.
- Cross border surveillance activities will be further strengthened through joint meetings, mentorship of trainees and monitoring, evaluation, and learning

Project 2: Enhancing One Health surveillance and control of vector-borne diseases related to climate change in the West Africa region (Senegal and Nigeria)

This study is conducted by the Institute Pasteur Dakar (IPD) and the Nigerian Institute of Medical Research (NIMR). The study aims to jointly undertake mixed retrospective-prospective research to determine the **effect of climate change on mosquito borne disease emergence, outbreaks and spread in Senegal and Nigeria** and establish a process for the systematic translation of strategies for the prevention, preparedness, and response, which can then be extended to other parts of West Africa.

Progress:

- A joint protocol was developed between Senegal Nigeria. Local ethical approval has already been attained for Nigeria in July 2023. Senegal's local ethical approval is pending but expected by the end of September 2023. The WHO ERC has approved the protocol and is only awaiting the local ethical approval for Senegal to provide final clearance.
- An induction ceremony/meeting was organized in Senegal with relevant stakeholders to familiarize all with the project objectives.
- A technical team has developed the technical study implementation tools.
- The team has had regular meeting internally as well as with TDR to discuss the work plan, progress and prepare for implementation phase/activities.
- Retrospective meteorological, disease prevalence and transmission data (for the past 10 years) on mosquito borne diseases in Nigeria and Senegal has been collected and is being analysed and prepared for publication in December 2023.
- Stakeholders were engaged from the One Health national committee of Senegal from the prime minister's office, along with its counterpart from Nigeria, to establish effective communication channels for strengthening regional collaboration and initiating a more holistic integration of research results into the policies.

Project 3: One Health approach to controlling and understanding the dynamics of fascioliasis and schistosomiasis in the context of climate change (Tanzania and Rwanda)

This study is conducted by the Kilimanjaro Clinical Research Institute (KCRI), the Tanzania Plant Health and Pesticides Authority (TPHPA) and the University of Rwanda. The aim of this study is to **co-develop comprehensive One Health approaches in Tanzania and Rwanda to tackle the complex transmission-enabling environment of the snail-borne trematodiases around fresh water-sources**. To achieve this.

Progress:

- Joint protocol was developed between Tanzania and Rwanda, as well as the study and data collection tools. Local ethical approval was obtained for Tanzania and Rwanda in March 2023. WHO ERC final approval is awaited.
- The team has had regular meeting internally as well as with TDR to discuss the work plan, progress and prepare for implementation phase/activities.
- Stakeholders were engaged from both countries and across sectors (public health, animal health, environmental practitioners and the Ministry of health) in order to build and establish effective communication channels for knowledge and skill sharing and integrated policy development.
- Study training tools have been prepared.

The planned activities are to train healthcare professionals and veterinarian diagnosticians on snail borne trematodiases, community awareness to raise awareness on risks and management and to promote preventative strategies, sampling of humans and animals for establishing point prevalence of schistosomiasis and fasciolosis and vector sampling to establish vector species and densities.

Project 4: Application of a One Health approach for reducing the burden of vector-borne diseases in vulnerable communities in the context of climate change (South Africa and Rwanda)

This study is conducted by the University of Kwazulu-Natal and the University of Global Health Equity. The aim of this study is **to develop metrics, a One Health implementation guide and a collaborative platform for the evaluation of One Health-based schistosomiasis prevention and control projects.** The study builds on previous models and will develop novel One Health operationalization metrics relevant for the prevention and control of schistosomiasis in the context of climate change among vulnerable communities. The findings of this exercise will be applicable to a broader range of One Health and Vector borne Disease settings. The collaborative platform will strengthen partnerships among African scientists and research institutions in the field of One Health implementation related to the prevention and control of VBDs in the context of climate change among vulnerable communities in Africa.

Progress:

- Joint protocol was developed between South Africa and Rwanda, along with the data collection tools.
- Provisional approval for South Africa has been attained by the Biomedical Research Ethics Committee of the University of KwaZulu Natal. However, local ethical approval for Rwanda is

still pending. Response to queries and requests raised by the local ethical committee have been submitted.
- The protocol has been submitted to WHO ERC for final approval.
- The team has had regular meeting internally as well as with TDR to discuss the work plan, progress and prepare for implementation phase/activities.
- Systematic literature review completed of appropriate indicators or metrics for use in evaluating/identifying a One Health program for the prevention and control of schistosomiasis. The Consortium has adopted One Health Training material developed by the WHO (https://openwho.org/courses/human-animal-health-sectors) for trainings.

Engagement with key OH stakeholders at HQ and regional level

TDR is part and contribute to the discussions of the WHO Internal Coordination on One Health-Technical Team (WIC-TT)

At regional level, we are collaborating with the climate and Health WHO unit and the OH for Africa unit. At the next One Health regional meeting in Africa (Q4 2023), we discussed with the organiser the participation of the researchers/PIs from each of the four One Health research projects to share the results on their projects. This will not only introduce the teams to all relevant stakeholders and integrate into the One Health network within the region but also help them establish the required One Health communication channels necessary to enable future research. This will also help strengthen and build on the network of researchers and professionals we have established through our One Health and Vector borne Diseases webinar series and that we mentioned above.

This ER is focus on VBD, but we should also mention that through the Zoonotic TB project, we established links with WOHA, the FAO and OH regional unit of the SEARO and WPRO regions and submitted a collaborative project to a Department of Foreign Affairs and Trade (DFAT) call and proposed a One Health approach to strengthening the surveillance and control of Zoonotic TB in Fiji, Indonesia, Lao PDR and Papua New Guinea.

Gender aspects:

- **Project in Uganda-Kenya:** The ratio of male to female investigators on the project is 5: 3. The project also involves women and other marginalized groups during the data collection process, training of frontline workers, and during the interview of community members to understand the gender influence or roles and related implications on leishmaniasis. The One Health course developed on Leishmaniasis includes a module on Gender, risk analysis and control of leishmaniasis in a One Health context. This module enables understanding of the gender concepts and their role in explaining leishmaniasis disease (its patterns/distribution, risk including climate change factors, and its control) in the One Health context. It reflects on how gender norms, roles and relations impact women and men's health and helps develop an appreciation of how gender intersects with other determinants of health. It also equips participants to plan for gender issues including gender-sensitive control and advocacy plans for leishmaniasis in the One Health context.

- **Project in Senegal-Nigeria:** The ratio of male to female investigators on the project is 15:4. This study is inclusive of data of individuals of all gender and analysis of data and considers appropriate sex-disaggregation. The team has also continued professional development for all research team members through completion of training course on Gender equality and sexual diversity and incorporated gender equality messaging in all its communication.
- **Project in Tanzania-Rwanda:** The ratio of male to female investigators on the project is 6:2. For all project activities and engagement/stakeholder meeting, attention has been on ensuring contributor equity (i.e. in gender, religion, ethnicity and age groups). Frequent evaluation of the degree to which proposed procedures will affect equity, human rights and gender is being conducted throughout the study.
- **Project in South Africa-Rwanda:** The ratio of male to female investigators on the project is 9:2. The study design considers how socially, and culturally ascribed gender roles and responsibilities contribute to failure by communities to reduce the burden of vector-borne diseases. And to lessen gender disparities regarding access to and control over the project's resources and benefits, the project team includes community members and researchers who include women, young people, and non-conforming people in strategic positions of power, throughout the stakeholder consultation and data collection process.

ER 1.1.7 Maximized utilization of data for public health decision-making

Pictures: (Left) Collection of routinely captured paper-based data from peripheral health facilities and digitization into electronic formats in the central office (Right) for operational research, Kyrgyz Republic.

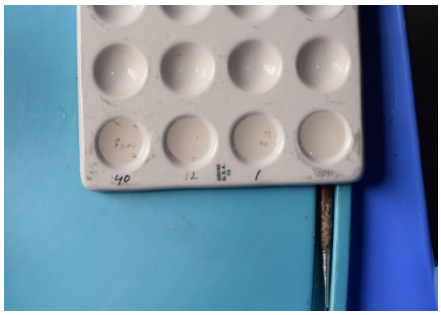
""I especially liked that through the SORT IT course I acquired many skills in a consolidated manner. The published articles that were the result of our joint work were very much appreciated by all my colleagues, and I have great believe they will make a significant contribution to informing policy and practice of the National Tuberculosis Program" Dr Konushbek Sakmamatov, Director Osh TB centre, Kyrgyzstan.

ER 1.2.1 Strategies to achieve and sustain disease elimination

Images from the field

Images of investigations of new foci in Bangladesh

Images of investigation of new foci in Bangladesh



Entomological Activities by CDC Light Trap

Images of investigation of VL follow up in Bangladesh

Follow up assessment of a treated VL patient

Specimen collection from a treated VL patient

Images of prevalence survey for PKDL in Bangladesh

Door to door Screening and consenting of the study participants.

Sensitization meeting at the district level and Training of the government and NGO health staff involved in leprosy management.

Images of PKDL survey in Nepal

Field workers in front of the Community Health Unit, Palpa and in Sarlahi district

Team of field workers conducting household PKDL screening, Surkhet

Clinicians PKDL orientation at Lalgadh

Donating rK39 test kits to Director of Anandaban Leprosy Hospital, Lele, Lalitpur

PKDL orientation to clinicians and lab workers at Anandaban Leprosy Hospital

ER 1.2.6 Optimized approaches for effective delivery and impact assessment of public health interventions

The activities conducted under this ER can be categorized as follows:

1. tuberculosis-related activities
2. malaria-related activities
3. NTD activities
4. drugs/vaccines safety monitoring, and pharmacovigilance activities
5. digital health activities

Progress in 2023

Tuberculosis-related activities

- Launch of the new regional network of National TB Programmes in Southern and Eastern Africa: Known as SEARN-TB, the network replicates the same model as the WARN/CARN TB network (see below) to promote greater coordination and communication between the NTPs and provide a platform for building IR capacity. A first webinar was held among NTP coordinators and representatives from 24 NTPs across the Southern and East Africa region and partners from WHO AFRO, EMRO and GTB in April. In 2023, the SEARN-TB network was financially supported by the German Federal Ministry of Health under the new project with the Robert Koch Institute (RKI; see below). Following the webinar, an in-person meeting was held in Addis Ababa, Ethiopia in May 2023 to formally establish the network by discussing and agreeing on the overall objectives, priority actions and functioning/operational structure of the network and identifying key challenges and priority areas for TB control and how IR can contribute to enhanced TB control in the region. The meeting was attended by NTPs coordinators or their representatives from 16 countries in Southern and East Africa, and colleagues from WHO Regional Offices and other partners. Key outputs from the meeting included a ratified Terms of Reference for SEARN-TB, the agreement of the Armaeur Hansen Research Institute (AHRI) as the network secretariat and the nomination of Malawi and Ethiopia NTPs to the role co-chair for a preliminary one-year term.
- As of 2022, 26 of the 27 countries (all except Capo Verde) in the WARN/CARN Regional Network for TB Control were actively engaged in TB research initiatives with support from TDR (See table in Annex 1). Following IMP-SWG guidance, an evaluation of the network was completed in 2022; findings were highly positive and demonstrated wide-scale support for the network continuation. The report highlighted that the emphasis on implementation and operational research was reported to have led to a better understanding of what works and informed emerging best practices for TB control among member countries (see Annex 2 for full evaluation report).
- Support from the German Federal Ministry of Health (BMG) in partnership with the Robert Koch Institute continued in 2023 though a new project to expand the scope of work conducted under the 2021/2022 BMG-funded project which sought to strengthen the surveillance capacity of national TB programmes (NTPs) in West and Central Africa to monitor and mitigate disruptions during COVID-19 and other, future PHEs. Recognizing the benefit of these activities, a new proposal was developed and funded to countries in the Southern and East African region. This one-year project provided seed funding to establish SEARN-TB (as described above) and conduct TB surveillance-strengthening and IR-capacity building activities with 24 NTPs in the region.
- TDR's involvement in strengthening social protection for people living with and affected by TB continued in 2023 through three key activities: 1) Continued ***Financial and technical*** support to six countries identified under the funding scheme launched in late 2022 to support IR projects in the WHO AFRO region and build the evidence base on the impact of social protection schemes for

TB patients and their families, conducted in collaboration with GTB, the Union, and Damien Foundation. Twelve applications were received and eight were selected for small grants funding of around 20,000 – 25,000 USD (two of whom are being funding by the Union, and Damien Foundation respectively). Project implementation began at the end of 2022 with final results expected by the end of 2023; 2) ***Development of a generic IR toolkit for evaluating the impact of social protection schemes for TB patients and their families,*** which was completed in September 2023 and will be shared with key partners and stakeholders for technical review and validation at the end of 2023 and; 3) S***upporting GTB to conduct a landscape analysis of social protection schemes in DRC, to*** gather evidence on key gaps and recommendations for strengthening the overall SP landscape in these contexts.

- The ShoRRT project continues, with 27 countries currently launching or conducting their OR project (see Annex 4 for country updates). Financial and technical support to study teams in Nigeria and the Democratic Republic of Congo continued in 2023 as part of USAID support. As part of TDR's support to countries, a generic statistical analysis plan was developed to inform a standardised approach to analysis of key treatment effectiveness, safety, and quality of life outcomes at end of treatment and follow up time points. Additional technical support by external consultants and the Luxembourg Institute of Health was provided to countries to support analysis.
- The **Diagnosis of Multidrug**- resistant tuberculosis in Africa (DIAMA) project funded by EDCTP and led by the Benin NTP, in collaboration with TDR and partners aimed at evaluating new molecular tests for drug-resistant TB (DR-TB) diagnosis and find new methods to replace processes for follow-up of DR-TB patients during treatment.Study results were shared with the WHO Global TB department to update GTB guidelines in particular for the endorsement of Xpert 2nd line drugs, Truenat and Genoscreen platform . Study results were disseminated through oral communications and scientific papers are under development.
- An evaluation of the level of **Implementation of the roadmap for Zoonotic TB promoting a One Health approach in Africa and South/West Pacific regions** was conducted in collaboration with the GTB department of the WHO, the FAO, WHO and the regional offices of the African, South East Asia and West Pacific regions: 1) assess the implementation of the "Roadmap for Zoonotic TB" in countries in Africa and Asia; 2) compile best-practice case studies on the successful operationalization of One Health, with particular focus on zoonotic TB; and 3) define a five-year action plan to strengthen the operationalization of the roadmap for the AFRO region. Survey results will be shared at the Union World TB conference (Nov 2023). A scientific paper is under development.
- The TDA4Child initiative kicked off in May 2023. Following the WHO interim conditional recommendation relating to the general use of integrated treatment decision algorithms (TDAs) for tuberculosis (TB) treatment decision-making in children in the 2022 WHO consolidated guidelines on the management of TB in children and adolescents, the TDA4Child initiative proposed tools aiming to facilitate the conduct of operational research, and to generate data that are harmonized across different implementation settings using a standardized methodology. Tools include: protocol, paper and electronic collecting tools, SOP, Manual of Operations and training material in French and English. Treatment decision algorithms are designed to help clinicians make a decision to start TB treatment in a child, based on microbiological, clinical and radiological evidence. Two evidence-based TDAs are included in the accompanying operational handbook on the management of TB in children and adolescents, aiming at improving case detection. TDR technically support the adaptation of the master protocol in Democratic Republic of Congo, Nigeria and Burkina Faso – where the study will be roll-out by the end of the year. A consortium with Benin, Senegal, Togo and Guinea is working on a regional protocol with the technical support of TDR and The Union. The goal is to gather data for the revision of the WHO recommendation by mid-next year.

Malaria-related activities

- Of the 13 SMC implementing countries, three NMPs have completed their studies: Guinea, Ghana and Nigeria presented their work at the 2023 ASMTH conference. Nigeria published their study results[1]. The NTPs of Guinea and Ghana drafted study manuscripts that should be submitted by the end of the year. Seven countries (Niger, Mali, Senegal, Burkina Faso, Cameroon, Benin, and Togo) have finalised their study and are analysing their results. The NTPs of Cameroon, Mali and Burkina Faso will present their results at the EDCP forum (November 2023 in Paris) during an SMC symposium. The three remaining countries (Chad, The Gambia, and Guinea Bissau) are in the process of finalising their projects proposals.
- TDR led the organisation of a one-week training on Implementation research with specific sessions on qualitative research. This was an online training aiming mainly at strengthening the capacities of the NMPs in the analysis of their study results and particularly their qualitative research data.
- In addition, TDR co-organised with WHO/GMP a meeting with representatives of all national malaria Programmes implementing SMC and international experts in the field to update the Seasonal Malaria Chemoprevention field guide (Seasonal malaria chemoprevention with sulfadoxine–pyrimethamine plus amodiaquine in children: a field guide (who.int)

- Supporting South-South knowledge exchange to support the roll out of the Malaria RTS,S vaccine. In January 2023, a face-to-face workshop co-hosted by the OPT-SMC initiative and TDR through the Access and Delivery Partnership (ADP) was organized in Dakar with technical input from GAVI, WHO/MVIP, the WHO Regional Office for Africa, PATH and other stakeholders. Representatives from the National Malaria Programmes (NMPs) and Expanded Programmes of Immunization (EPI) from the 13 OPT-SMC African countries were invited. The objective was to discuss implementation strategies and mode of delivery in countries with seasonal Malaria high transmission and low or moderate EPI coverage during the 1st and 2nd year of life. The study report was published. The operational/implementation research needs to document the implementation of RTS,S and other malaria vaccine in this epidemiological context in terms of uptake and effectiveness, safety and acceptability was also discussed, and a list of questions raised by the NMPs and EPI programmes are provided at the end of the study report.

NTD-related activities

- ***SKIN NTD:*** Supporting the NTD department of Ghana Ministry of Health to conduct implementation research for identifying and addressing gender-related barriers to skin NTDs: Support was provided to the Ghana National Buruli Ulcer and Yaws Eradication Program of the Ghana Health Service to evaluate gender-related factors affecting access to health services and care of skin-related neglected tropical diseases (skin NTDs) in three districts in Ghana, both from the perspective of patients and of healthcare workers. The study highlighted that while women had better knowledge of the causes and symptoms of skin NTDs than men and would seek treatment at hospitals preferentially over herbalists (the opposite to the treatment-seeking behaviour of men), women's treatment-seeking behaviour was strongly influenced by men due to unequal power relations, gender roles and access to resources. This will inform Ghana's plan to integrate NTDs care into basic health services, taking into account gender-based specificities. A feasibility study to test the WHO skin NTDs through a mobile app is at a final stage of completion.

- ***Schistosomiasis:*** TDR is supporting the MOH in Tanzania for the introduction of ePraziquantel which is the paediatric formulation of Praziquantel. This activity is in anticipation of marketing approval. This is done as part of the ADP project with contribution of other ADP partners such as PATH for the forecasting and procurement aspects and WHO regulatory department for the regulatory approval process. TDR is mainly providing technical and financial assistance to the National Institute for Medical Research of Tanzania for preparatory work with raising

awareness within the community, identifying potential introduction barriers within the community, definition of the best model of delivery to consider (national dialogue meeting and key stake holders engagement) and the development of an implementation research protocol for evaluating the three delivery models that were proposed during the national dialogue and strategies for involving community-in the delivery. Further support is provided to including a costing element in the research project.

- ***Onchocerciasis:*** TDR is collaborating with Medicines Development for Global Health (MDGH) for the conduct of an implementation study in Ghana for measuring the acceptability, feasibility & community preferences. This is needed for finalising the moxidectin portfolio for WHO/NTD review for guidelines (planed in 2024)

Drug and vaccine safety and pharmacovigilance (PV) activities

- In 2023, TDR continued to support the use of digital health technologies for safety and pharmacovigilance – specifically the MedSafety app, USSD coding system in Burkina Faso and Malawi, respectively (these activities are further described under section 5: digital health –related activities). In addition to supporting the evaluation of the USSD system in Malawi, TDR has also continued to support the Pharmacy and Medicines Regulatory Authority of Ghana in completing the evaluation of the impact of training on PV among health care workers. The Ghana team submitted a manuscript that was accepted for publication and the Malawi team is drafting a paper to share their results. It should be submitted for publication by the end of 2023.
- **A**ctivities concerning TB drug safety monitoring and management (aDSM) activities and implementation in 2023 included: 1) updated aDSM resources for in-country training in both French and English languages, in line with WHO guidelines; 2) South-South visits to strengthen the regional technical capacity between NTPs in Senegal (three selected staff), the Democratic Republic of the Congo and Burkina Faso to support the development and testing of national aDSM guides, and 3) development of a training material on aDSM that can be used by countries. It should be made available on TDR website by the end of 2023.

Digital health

- TDR's work done in this area is summarized on this TDR page.
- The Implementation Research for Digital Technologies and TB (IR4DTB) toolkit was used as the central teaching tool for a week-long workshop in the WHO AFRO region targeting NTP staff in May 2023. Following the workshop, 16 proposals were received, 11 of whom are being supported with financial and technical support to conduct IR to test, evaluate and/or scale up new digital technologies within the context of a country's national response to TB. Ongoing support was also provided to the six country teams funded after the 2022 IR4DTB workshop in the WHO EURO region, most of whom are evaluating the use of computer-aided detection (CAD) software for TB screening, including conducting calibration studies using the CAD for TB detection calibration toolkit. Final results and study manuscripts will be completed by the end of 2023.
- **IR on** digital tools in Burkina Faso: TDR continued to support Burkina Faso's National TB Program (NTP) in 2023 to introduce and evaluate **99DOTS,** a digital tool used to alleviate the requirement of frequent trips to and from the health facility as part of the requirements of Directly Observed Treatment required for TB patients, by monitoring treatment adherence at a distance. In 2022, TDR supported the NTP to pilot and an evaluation was commenced to assess the acceptability and utility of 99 DOTS. In 2023, intermediate analysis has been done, which found that … These results were accepted for oral presentation at the Union World Conference on Lung Health, in Paris in November 2023. *U*se of the MedSafety App for adverse drug reaction (ADR) reporting: Support was given to the

Agence nationale de regulation pharmaceutique (ANRP) to develop a protocol to evaluate the implementation, acceptability and feasibility of the app and its impact on the ADR reporting rate. This research is currently under way.

ER 1.3.12 Strategies to promote gender-responsive health interventions on prevention and control of infectious diseases of poverty

TDR MOOC ON INCORPORATING AN INTERSECTIONAL GENDER PERSPECTIVE IN IMPLEMENTATION RESEARCH (IR201en)

1. **Background**

The African Regional Training Center (ARTC) located in the School of Public Health, University of Ghana with support from WHO-TDR, ran a session of the MOOC on Incorporating an Intersectional Gender Perspective in Implementation Research from **October 24 to November 16, 2022 a**nd also in **September 2023. Details from the 2022 fall session are included below. Details from 2023 will be added when available, at the end of 2023.**

2. **Participation**

Running of the MOOC session was announced on October 13, 2022. Information regarding this was disseminated through the ARTC networks (e.g. TDR alumni, UGSPH postgraduate students, etc.) following which the African Regional Training Center received applications from prospective participants. All were requested to register by using the Google form link provided by email. Registration was also open to all applicants from other WHO-Regions. At the end of the registration period, 213 registrants were enrolled onto the course site. On commencement of the MOOC session, there were 174 participants who had activated their accounts to take the course.

Data was collected from 212 participants out of which 109 (51.4%) were males and 103 (48.6%) were females. Of the number of participants, 62 (29.2%) were between 20 - 30 years, 96 (45.3%) were between 31 - 40 years, 40 (18.9%) were between 41 - 50 years, and 14 (6.6%) were between 51 - 60 years. Ninety-four (44.3%) participants had a Masters degree while Bachelor, Doctor of Medicine, PhD degree and Diploma holders were 94 (44.3%), 20 (9.4%), 1 (0.5%) and 3 (1.4%) participants respectively.

With regards to nationality, 199 (93.9%) participants were from the African continent, 8 (3.8%) were from Asia, 3 (1.4%) were from Europe and 1 participant (0.5%) each came from North America and from South America.

5. **Course Assessment**

Participants were required to take an assessment at the end of the course which is comprised of 5 sections. A passing grade of 80% was the eligibility criteria for receiving a certificate of satisfactory completion. At the end of this final exercise, 76 participants (43.7%) out of 174 active participants successfully completed the MOOC session and were issued their certificates.

6. Participants' Feedback of the Course

At the end of the MOOC session a Google form link for a post course survey was sent out to the participants by email and 48 responses were received. The feedback that was received was based on demographic characteristics and the MOOC experiences of the participants.

6. Demographic characteristics

The demographics of the post survey indicated that the majority of the respondents were male (64.6%) while more than 93% of the respondents live in Africa. Twenty-two (45.8%) respondents had a Masters degree, 20 (41.7%) had a Bachelors degree and 5 (10.3%) had a PhD/doctorate/MD qualification. Forty-five (93.8%) of the respondents had qualified for a certificate.

7. Participants' learning experience

Among the respondents, 70.8% had previously taken the IR MOOC on Infectious Diseases of Poverty. Overall, majority of the participants were satisfied with the content and running of the course with 85.5% of them rating the course as very good/excellent. Regarding previous experience with gender-based research, 62.5% of respondents had had substantial exposure and most individuals took the course to improve on their knowledge/speciality (75.1%). About 76% of participants felt that the course met their expectations to a moderate/large extent. The post survey respondents' feedback of the learning experiences is presented in Table 1 below.

Table 1: MOOC experiences of post survey participants

MOOC EXPERIENCE	FREQUENCY (N=48)	PERCENTAGE (%)
PREVIOUS PARTICIPATION IN TDR IR MOOC		
Yes	34	70.8
No	14	29.2
EXPERIENCE WITH GENDER BASED RESEARCH		
Not at all	12	25.0
To a small extent	6	12.5
To some extent	15	31.3

To a moderate extent	10	20.8
To a large extent	5	10.4
REASONS FOR TAKING THE GENDER MOOC		
Out of academic interest	11	22.9%
For self learning purposes	13	27.1%
To solve a professional problem	2	4.2%
I have a particular interest in IR	1	2.1%
To further specialise in my field	20	41.7%
To be able to design and implement quality research with gender perspectives	1	2.1%
DID THE MOOC MEET YOUR EXPECTATIONS?		
Not at all	-	-
To a small extent	-	-
To some extent	2	4.2%
To a moderate extent	14	29.2%
To a large extent	32	66.7%
RATING OF THE MOOC SESSION		
Excellent	26	54.2%
Very good	15	31.3%
Good	6	12.5%
Fair	-	-
Poor	1	2.1%

Many of the participants appreciated the content and mode of delivery of the MOOC session. They saw it as an opportunity to build research capacity and the flexibility in the course schedule was seen as beneficial. These points are highlighted in some of the narratives from the respondents below:

'This is indeed a well detailed lecture.' (R3)

'More of such MOOCs to help build capacity for more research in IR is important and recommended.' (R10)

'This programme is very educative and interactive.' (R30)

'It is a very good opportunity for us to build our career and professional competencies and knowledge.' (R34)

'This is an excellent platform with flexibility in partaking a course. I'm grateful for such an opportunity.' (R44)

Some of the challenges respondents faced had to do with internet connectivity, and their inability to download the videos.

The IR201en MOOC session was successful, and the participants were very pleased with the content and administration of the course. Seventy-six (43.7%) participants successfully completed the MOOC. We are of the opinion that majority of the participants were able to gain knowledge on incorporating an intersectional gender perspective in Implementation Research and will be able to positively impact on research in their various settings.

ER 1.1.5 Directions for development and accelerated access to new tools and strategies

ER 1.3.10 Urban health interventions for vector-borne and other infectious diseases of poverty

Urban health is influenced by several factors, including governance, population features, urban planning and socioeconomic development and health services, among others, which in turn have major implications for social and environmental determinants of health. Vector-borne diseases, whose agents (parasites, viruses etc) are transmitted by insect vectors such as mosquitoes, flies and triatomine bugs, occur in more than 100 countries worldwide and affect about half of the world's population. The incidence and distribution of infectious diseases is consequently influenced by social, demographic and environmental factors that interact under a changing climate and affect pathogen transmission patterns, especially increasing risk of infection in urban areas.

ICMR team, India:

As a result of the systematic reviews, the research team have published four articles in peer reviewed journals, submitted a fifth manuscript for publication and have developed two evidence briefs for dissemination. The details about the submitted manuscript and evidence briefs are as below:

List of papers and evidence briefs developed in India

Name of paper	Name of Journal	Status
A systematic review on COVID-19 pandemic-related gender-based violence among urban poor in Low- and Middle-Income Countries	Violence Against Women	Submitted for publication in September 2023
Improved housing, water, sanitation and hygiene, and community engagement among urban poor towards Sustainable Development Goals: Lesson from COVID-19		Policy brief developed after consultation with various stakeholders from Government, non-government agencies, academia and community members
Gender-based violence (GBV) associated with COVID-19 in urban slums of low- and middle-income countries: an evidence brief for policy and practices	Target journal: WHO Bulletin (Policy & Practice).	

Photo: Stakeholders dissemination meeting in Bangladesh

Icddr,b team, Bangladesh:

The icddr,b team conducted a systematic literature review on social determinants of urban health and identified effective community-based interventions to prevent and control infectious diseases in urban informal settlements. As a result, they developed two manuscripts and two evidence briefs as detailed below:

List of papers and evidence briefs developed in Bangladesh

Name of paper	Name of Journal	Status
Protocol for a systematic review on exploring the implications of the social determinants of health and identifying effective community-based interventions to prevent and control infectious diseases in urban informal settlements in low- and middle-income countries.	BMC Systematic Reviews	Submitted
Implications of the social determinants of health and identifying effective community-based interventions to prevent and control infectious diseases in urban informal settlements in low- and middle-income countries: a systematic review	Europe PMC	Pre-print
Understanding the social determinants of urban health and identifying solutions to combat infectious diseases in urban Bangladesh.		Evidence brief
Implications of the social determinants of health and identifying effective community-based interventions to prevent and control infectious diseases in urban informal settlements in low- and middle-income countries: a systematic review		Evidence brief

Photo: Policy dialogue held on 29 March 2023 involving high level stakeholders in Bangladesh

ER 1.3.14 Testing of innovative strategies for vector control

ER 1.3.11 Multisectoral approach to prevention and control of malaria and emerging arboviral diseases

Background and context

Vector-borne diseases, including malaria and emerging arboviral diseases, account for about one quarter of all infectious diseases. Although there has been noteworthy progress for malaria, with a recent decrease in malaria morbidity and mortality rates, other diseases, such as those caused by arboviruses like dengue, chikungunya, yellow fever and more recently Zika, are expanding, with an increased number of cases and geographical distribution. It has become evident that the prevention and control of these diseases must include more than a single orientated approach, since the transmission patterns are driven by vector host-pathogens relationship where natural conditions, human societies and vector parameters are dynamically interacting. Further, the Global Vector Control Response (GVCR) 2017–2030, which was approved at the World Health Assembly in 2017 by more than 190 Member States (WHO 2017) considers the intra- and intersectoral approach as one of the 4 pillars to achieve efficient vector and vector-borne diseases control.

The rationale of this expected result is to better understand how to implement an efficient multisectoral approach (MSA) for preventing and controlling vector-borne diseases (VBDs) since although MSA has been widely used and recommended, the theoretical baselines and the "*how to*" are missing. This ER will also work on developing tools, framework, and guidance on MSA as well as test the approaches with case studies in field conditions.

This activity started in 2016 as a collaboration on MSA for the prevention and control of malaria and emerging arboviral diseases between TDR, the Swiss Development Cooperation (SDC) and the Canadian International Development and Research Centre (IDRC) to build a multi-disciplinary approach. Following these first steps a collaboration was established in 2019 with the WHO Water and Sanitation (WASH) group and supported by funding from the Sweden International Development Agency (Sida) to strengthen countries' capacity on MSA against VBDs with a focus on the WASH sector. Finally, the relevance of the MSA against malaria allowed for a collaboration with the Global Malaria Program from WHO (GMP/WHO) and the National Institute of Poverty Diseases from China (NIPD) through funding from the UN (United Nations) Peace and Development Sub-Fund (UNDESA) to test new approaches on malaria control in 4 African countries (Burkina Faso, Senegal, Tanzania, and Zambia). Most of the case studies supported through this project will end by December 2023, but the Expected Results is planned to continue for at least 2 more years (2024 and 2025) to extract the lessons learned and develop more material such as a training course for guiding MSA implementation. All collaborations developed with different partners for this project were technical and financial and a summary of the steps within this overall project is provided below:

Years	*Activities*	*Outputs/Outcome*
2016-2017	Building partnership around MSA	Workshop in Geneva
2017-2019	Commissioned reviews supported	Special Issue published
2018-2020	Development of a Framework	Document published
2019-2022	Collaboration with WHO/WSH	3 Case studies, 2 completed
2021-2023	Collaboration with GMP/WHO	1 case study, Training Workshop

Case study 1 - A PILOT MULTISECTORAL INTERVENTION FOR CONTROLLING MALARIA VECTORS, MITIGATING INSECTICIDE RESISTANCE, AND ASSESSING WASH FACILITIES AT HEALTH CARE UNITS IN SELECTED COASTAL AND SAHELIAN WEST AFRICAN COUNTRIES.

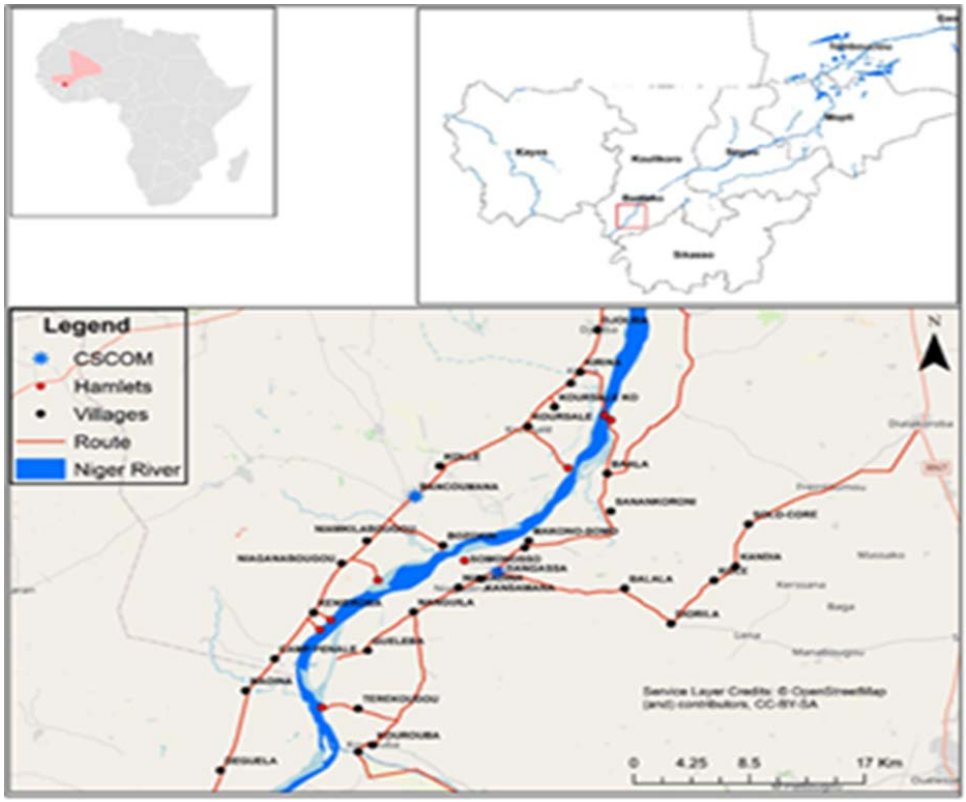
Progress in 2023

Abstract and Main Results until June 2023 (project ending in November 2023)

Apart from the classical malaria control interventions, we propose a new holistic multisectoral approach for addressing residual malaria in this research. Working with a team of scientists from ***public health***, ***environment***, and ***agriculture*** (One-Health approach), as well as other public and private sectors (***education***, ***community participation***, ***market for bed nets***, and others), we will address malaria vector control in targeted hotspots such as rice fields, riverbeds, and vegetable farms. We shall also investigate ***water use, hygiene, and sanitation*** (WaSH) at healthcare facilities in target study sites. Our proposed research activities will contribute to the reduction of vector densities and the mitigation of insecticide resistance in the Anopheles populations in the selected hotspots. We will also conduct insecticide residues check on bed nets collected at the point of sale in markets to ensure their effectiveness prior to field use for mosquito control. This study will also picture out current WASH practices at the community level in the 4 project countries to gather preliminary information for future interventions in this field.

Four (4) hypotheses form the basis of our proposed multisectoral approach for malaria vector control: (H1) The reduction of mosquito densities through community participatory activities and multisectoral interventions (Agriculture, Environmental, and Health) in selected hotspots such as rice fields using proven agronomy practices coupled with physical modification/destruction of Anopheles breeding habitats in riverbeds during the dry season will improve the control of this disease towards its elimination. (H2) The effective use of agricultural insecticides for pest control will reduce the presence of residues in mosquito breeding sites and contribute to mitigating the observed spread of insecticide resistance in malaria vectors. (H3) The quality check of insecticide levels in LLINs (long lasting insecticidal nets) sold in markets will improve the performance of this tool used for malaria vector control. (H4) Documenting current WaSH practices will contribute to improving the WaSH conditions in healthcare facilities for improved quality of care, reduced risk of nosocomial infectious diseases transmission, and reduction of mosquito breeding habitats.

Objective 1 - To reduce by more than 50% the densities of Anopheles breeding sites and larval densities in riverbeds during the prolonged dry season in Mali.



Results - Adult mosquitoes were collected every two weeks using pyrethrum spray catch in parallel in 20 human dwellings of each of the localities of the intervention and control portions of the riverbed to estimate mosquito density. This allows us to estimate the effects of the different interventions (larval habitats destruction and/or treatment with BTi, and mosquito swarm killing) on the entomological parameters of malaria transmission by comparing the intervention and control portions of the river. ***Mosquito's densities were reduced by 66.7% and 61.1% in the intervention portion compared to the control one in March and April 2023***, respectively.

Objective 2 - To reduce by more than 50% the quantity of insecticide residues in soil and water (Anopheles breeding sites) compartments in vegetable production sites.

Results - Even at low doses, ***insecticide residues in soil could contaminate runoff and select for insecticide resistance in non-target organisms like anopheles, a major malaria vector***. The high level of insecticide residues (emamectin benzoate) in cabbage farming was the consequence of the misuse of insecticides and cabbage leaves that do not allow sunlight to easily destroy insecticides. Such a situation could pose serious health issues.

Objective 3 - To improve (through quality checks) by more than 50% the effectiveness (bio-efficacy and recommended insecticide residues) of the LLINs obtained at the point of sale in the communities.

Results - Insecticide-treated nets are readily available at point-of-sale in Lagos, Nigeria however, most of the available nets are deltamethrin-treated nets. All the available nets are effective against susceptible laboratory strains of Anopheles gambiae 24 hrs post-exposure and alphacypermethrin-treated nets have the highest knockdown ability. Samples of the nets are being processed using HPLC-DAD protocols for screening collected samples for insecticide residue estimation.

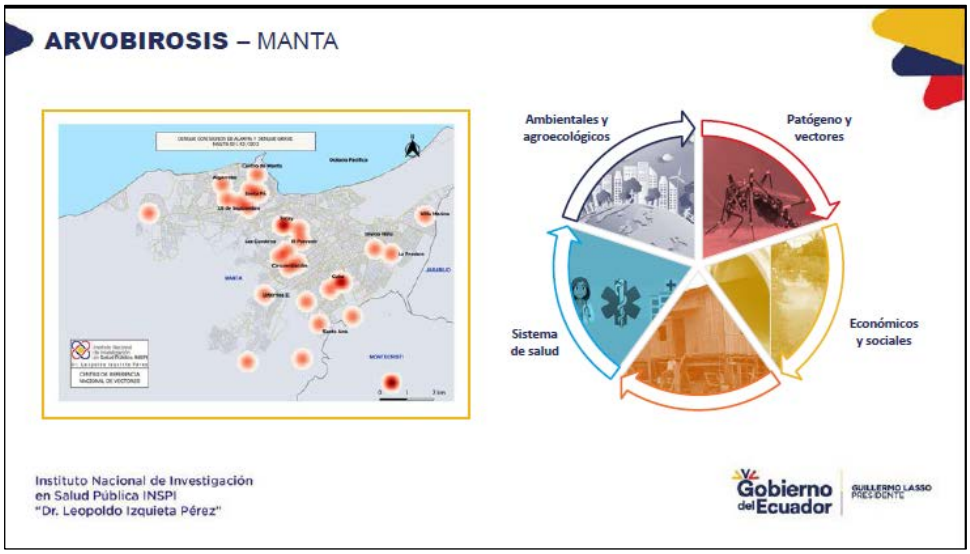
Objective 4 - Assessment of WaSH facilities and practices for improved reduction of infectious diseases transmission at health care units – Burkina Faso.

Results - The results show the ***weakness of the WaSH service in the health centers. Latrines and toilets are inadequate for most users and the hand-washing facilities were absent***. Respondents have some knowledge of vector-borne diseases and Anopheles was cited as the main vector of malaria, which proliferation was attributed to vegetation, water channels, puddles, and rice fields

CASE STUDY 2 - Establishment of a multisectoral strategy integrating Health, Environment, Education, Sanitation and Water sectors to control and reduce mosquito populations in order to prevent transmission of Aedes-borne diseases, in the city of Manta, at the coastal region of Ecuador

Progress in 2023

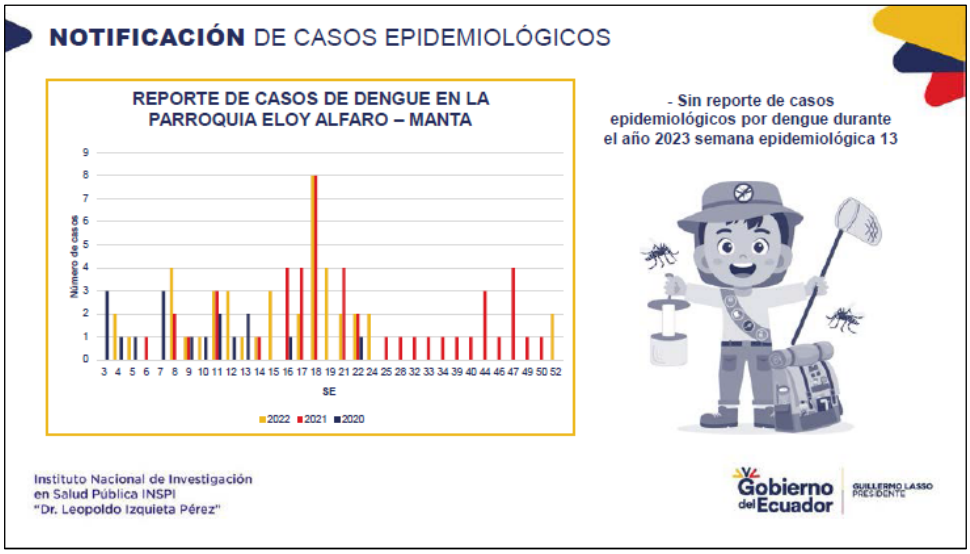
Presentation of the project (ended in June 2023)




CONSORCIO MULTISECTORIAL
Ministerio de Salud Pública
INSTITUTO NACIONAL DE INVESTIGACIÓN EN SALUD PÚBLICA
Ministerio de Educación
MANTA ALCALDÍA
UTE EC
SEGINUS
Uleam
SENEPA
Instituto Nacional de Investigación en Salud Pública INSPI "Dr. Leopoldo Izquieta Pérez"
Gobierno del Ecuador
GUILLERMO LASSO PRESIDENTE

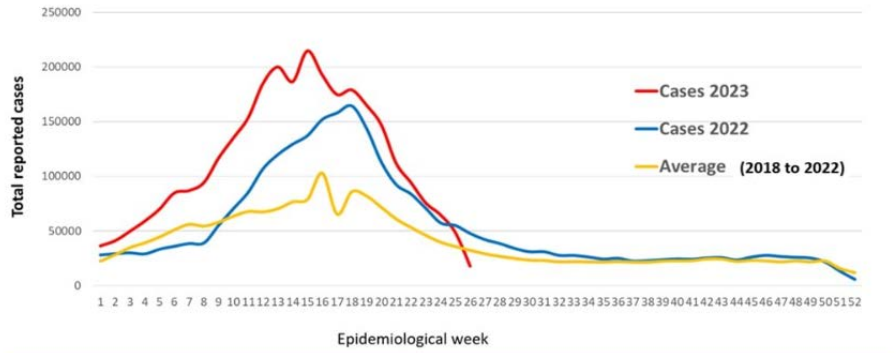

EJECUCIÓN DE ACTIVIDADES
Etapa 1
Etapa 2
Etapa 3
Etapa 4
Etapa 5
Etapa 6
Etapa 7
Etapa 8
Desarollo de actividades
Instituto Nacional de Investigación en Salud Pública INSPI "Dr. Leopoldo Izquieta Pérez"
Gobierno del Ecuador
GUILLERMO LASSO PRESIDENTE

Results


NOTIFICACIÓN DE CASOS EPIDEMIOLÓGICOS
REPORTE DE CASOS DE DENGUE EN LA PARROQUIA ELOY ALFARO – MANTA
Número de casos
SE
2022 2021 2020
- Sin reporte de casos epidemiológicos por dengue durante el año 2023 semana epidemiológica 13
Instituto Nacional de Investigación en Salud Pública INSPI "Dr. Leopoldo Izquieta Pérez"
Gobierno del Ecuador
GUILLERMO LASSO PRESIDENTE

Situation of dengue in the Americas at Week 13, 2023, peak of the dengue epidemic.

Figure 1. Number of dengue cases in 2022, 2023 (up to EW 26) and average of the last 5 years in the Region of the Americas



Source: Data entered into the Health Information Platform for the Americas (PLISA, PAHO/WHO) by the Ministries and Institutes of Health of the countries and territories of the Region. Available from: https://opendata.paho.org/en. Accessed July 11, 2023.

CASE STUDY 3 - ESTABLISHMENT OF A MULTISECTORAL STRATEGY INTEGRATING HEALTH, ENVIRONMENT, EDUCATION, SANITATION AND WATER SECTORS TO CONTROL AND REDUCE MOSQUITO POPULATIONS in order to prevent transmission of Aedes-borne diseases, in the city of Manta, at the coastal region of Ecuador

Progress in 2023

Abstract and Main Results (project ended in July 2023)

This project brings a multidisciplinary team from different institutions that focused on Zika virus (ZIKV), Chikungunya (CHIKV) and dengue (DENV) and the correlation to entomological and socioeconomic factors over the last few years; the inception of this project was in response to the demand from Brazilian society about *Aedes aegypti* mosquitoes and associated viruses. This study was developed in Estrutural City, the poorest city in Brasilia which historically hosted the largest open dump in America Latina and second largest in the world for almost 60 years. We aimed to 1) analyse the sanitation conditions in two different areas of Estrutural City including waste selective collection and water quality, 2) analyse the population density of Ae. aegypti and develop a strategy for the identification of mosquito species, and 3) carry out qualitative research and health education with the population of Estrutural City to understand their needs and knowledge about sanitation.

This multisectoral approach included the health sector, the ***water and sanitation***, the ***education,*** and the ***communities***.

This city was divided into two areas for comparison: Area A- with no sanitation cover; Area B- with sanitation cover. A total of 60 houses (30 from each area) were sorted to participate in the study. We also delivered water tanks, waste trashes and waste bags in area A to support these people to discard correct their trash. The collective health activities were done in 15 daycare centres with parents, children, and teachers, in Resident`s Associations with the community and in the Health Care Center of the city with the users of the Public Health System. Health education was also provided to the population during these activities. Water quality was analysed considering physical and biological parameters. We analysed the population density of *Ae. aegypti* during 11 months in both areas and compare the results with the baseline.

Houses in Area A showed poorer conditions in comparison with B, with more debris in or around (A: 80%, B: 57%), open sewage disposal (A: 20%, B: 3%), wooden houses (A: 43%, B: 3%) and ground water reservoir (A: 30%, B:10%). Our water quality results indicate total coliforms and E. coli were detected in high concentrations in Area A, showing that people who live in this area are more vulnerable to waterborne diseases. The main deliverables of our project were: 1) ***high frequency and density of Ae. aegypti in a very poor city in Brasilia*** after an entomological survey in 60 houses during 11 months, ***showing that mosquito density and frequency is influenced by sanitary conditions and also that water quality is poor in our study area*** and 2) development of a new strategy for morphological identification of Culicidae in system (CULICIDEX) for 11 genera and 26 mosquito species, 3) people were very receptive and interested in sharing knowledge to change their habits to promote health. ***One particularly good outcome was the decrease in dengue`s cases in the area since the beginning of the project, as reported by the communities***. These findings and actions will provide new control alternatives for arboviruses in risk areas and contribute to continued public health policies and basic services to be provided to the vulnerable communities.

Water storage before the study and delivery of water tanks.

Distribution of trash can and education for communities on water and sanitation and garbage.

CASE STUDY 4 - Approches multisectorielles pour lutter contre le paludisme au Burkina Faso : étude des différents secteurs dont l'activité a un impact sur la transmission du paludisme et mise en place d'une coordination multisectorielle pour implémenter et évaluer au moins une activité jointe permettant de diminuer la transmission

Progress in 2023

Résumé

Les objectifs de cette étude de cas sont de développer les outils et les approches permettant de garantir la participation de différents secteurs d'activité (autres que la santé) à la lutte contre le paludisme au Burkina Faso. Cette étude sera basée sur le cadre conceptuel développé par TDR et publié en 2020 qui recommande l'établissement de la liste des secteurs concernés, l'analyse des besoins et impacts de chaque secteur, la mise en place d'un comité de coordination multisectoriel et l'implémentation d'activités jointes bénéficiaires à la fois aux secteurs participants et aux populations par une diminution de la transmission du paludisme.

Les résultats attendus de cette étude de cas sont donc la réalisation de la liste des secteurs (autres que la santé), tels que l'agriculture, l'énergie, le développement des infrastructures, et d'autres qui ont un impact sur la transmission du paludisme. Cette liste doit également inclure les secteurs dont l'impact n'est pas matériel, tels que l'éducation. Un second résultat attendu est l'analyse des avantages directs (économiques et autres que la santé des populations) pour ces secteurs afin de les inciter à participer activement à la prévention et la lutte contre le paludisme.

Ces résultats seront ensuite utilisés pour tester la mise en place sous l'égide des autorités d'un Comité de Coordination Multisectoriel qui comprendra des représentants des divers secteurs concernés. Ce comité peut/doit s'appuyer sur des structures existantes. Ce Comité pourra être testé et validé en proposant une activité multisectorielle jointe, dont les résultats seront analysés non seulement en termes de réduction de la transmission du paludisme, mais également en termes d'avantages pour les secteurs participants.

Cette étude de cas se conclura par un rapport technique d'activité et des recommandations sur les approches multisectorielles, pour un déploiement plus large de ces approches.

Objectif 1 - Identifier les secteurs non santé qui pourraient apporter un appui dans la lutte contre le paludisme en 2022.

Résultats - Les secteurs contactés et interwievés sont les suivants: Education, Transports, Urbanisme, Eaux et Hygiène, Economie and Finances, Agriculture, Environnement and ONGs.

L'analyse des enquêtes réalisés auprès de ces secteurs don't la liste est indiquées dans le tableau ci-dessous sont en cours.

AMBF (Association des municipalités du Burkina Faso)	Mairie	Chargé de communication
CCM (Instance de coordination nationale des subventions du Fonds mondial)	PTF	Coordonnateur Nationale des Subventions du Fonds Mondial
DGESS MENAPLN (Direction générale des études et des statistiques sectorielles Ministère de l'Education Nationale et de l'Alphabétisation et de la Promotion des Langues Nationales)	Education Nationale	Directeur générale des études sectorielles au ministère de l'éducation nationale et de l'alphabétisation et de la promotion des langues nationales
DGESS (Direction générale des études et des statistiques sectorielles) ministère de transport	Ministère de transport	Directeur général des études et des statistiques sectorielles du ministère de TRANSPORT
DIRECTEUR URBANISME (directeur de la formation des politiques et au niveau du ministère de l'urbanisme des affaires foncières et de l'habitat)	Ministère de l'urbanisme	Directeur de la formation des politiques et au niveau du ministère de l'urbanisme des affaires foncières et de l'habitat
DREA (Direction générale et de statistique sectoriel, du ministère de l'eau et de l'assainissement)	Ministère de l'eau	Directeur général et de statistique sectoriel, du ministère de l'eau et de l'assainissement
DPP, Ministère de l'économie et des Finances	Ministère de l'économie et des finances	Administrateur de base de données
AGRICULTURE	Ministère de l'agriculture	Agent responsable d'hygiène publique au ministère de l'agriculture
Direction générale des études et des statistiques sectorielles représentant Ministère de l'Environnement	Ministère de l'Environnement	Directeur générale des études et des statistiques sectorielles représentant Ministère de l'Environnement
TERRE DES HOMMES	ONG terre des hommes	Agent ONG terre des hommes

Objectif 2 - Définir les objectifs et termes de référence pour constituer un comité de coordination multisectoriel fonctionnel

Résultats - les termes de références du Comité multisectoriel pour la lutte contre le paludisme au Burkina Faso ont été écrits et communiqués au Ministère de la Santé.

Objectif 3 - Implémenter une activité conjointe avec la participation de plusieurs secteurs sanitaires et non sanitaires, et analyser les résultats et bénéfices de l'activité

Résultats - l'activité multisectorielle d'élimination des gîtes larvaires des moustiques vecteurs du paludisme a été déployée conjointement entre les secteurs de la santé, de l'aménagement des infrastructures (routes) de l'environnement et des communautés dans la ville de Manga entre les mois de Juillet et Septembre 2023. Les résultats des suivis entomologiques sur l'impact de l'activité sur les populations de vecteurs sont en cours d'analyse.

La participation des différents secteurs a été une réussite en termes de participation.

Comblement des gites à vecteurs du paludisme sur les routes à Manga, Burkina Faso, dans le cadre d'une collaboration multisectorielle

Training activitIES ON MUltisectorial collaboration against vector-borne diseases

Progress in 2023

MSA MOOC

Module 1 of the MOOC available online in French and English: https://vbd-environment-mooc.org/

Modules 2 to 6 in development.

MOOC will be released in the first half of 2024.

MSA training workshop, held in Saly, Senegal, 11-14 September 2023

The training workshop on multisectoral approaches (MSA) to the prevention and the control of vector-borne diseases took place from the 11th to the 14th of September 2023 at Lamantin Beach hotel at Saly, Mbour, in Senegal where the following countries were represented: Burkina Faso, China, Côte d'Ivoire, France, Ghana, Mali, Niger, Portugal, Senegal, UR Tanzania, USA and Zambia. On the 1st day, the training was opened and welcomed by the Coordinator of the National Malaria Control Program of Senegal on behalf of the Ministry of Health and Social Action. After a round table of introduction for the participants, the scientific presentations from the invited experts were delivered.

On day 2 of the workshop, two working groups were formed (anglophone and francophone groups) to list the sectors other than health sector which have an impact in the transmission of malaria in their respective countries and to discuss the type of impact, as well as the existing (or not) relationships with the health sector. The discussion was then engaged on how to develop collaborations with those sectors and propose concrete collaborative activities.

A visit field to the health District of Popenguine (Mbour) was organized by the NMCP of Senegal on day 3 to visit the health centre and encounter the Chief Medical officer presenting the malaria situation in the district, with a reduction of malaria cases in 2023, due to good access to health facilities and promotion of health and bednet by other sectors. Then, the participants visited the fishing dock of Ndayane to know more about the strategies these people had undertaken to fight against malaria in the area. The President of the Association of the fishermen of Ndayane explained his missions in the Association which dealt with sensitizing them against malaria and encouraging them to use long lasting nets at home to prevent from malaria. A community relay and a local sensitizing woman called "Badjenou gokh", as the President of the women of the area explained, in addition, that they had implemented the strategy "zero malaria, I'm committed" by setting up actions such as the regular use of long-lasting nets in all the houses of the area and the development of campaigns to raise awareness among women.

On day 4, the two working groups made a restitution of their work, each of them listing the sectors having an impact on malaria transmission acknowledging that some sectors do have only a positive impact such as the Education. The working group concluded by proposal of activities to be

implemented in each of the 4 countries of the UNPDF project in collaboration with other sectors.